# *Electric Load Forecast*

***2001/02-2021/22***

***Prepared by:***
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# EXECUTIVE SUMMARY

This document outlines the assumptions, information sources, and process used to prepare the 2001 forecast, and explains the drivers, factors, and uncertainties influencing future electricity demands. The electric load forecast is one of the key drivers of BC Hydro's planning activities. The primary purpose of the electric load forecast is to address the key questions of "when, where, why, and how much" electricity will be required on the BC Hydro system to allow BC Hydro to evaluate future investments and planning alternatives. The electric load forecast is the basis for projecting domestic sales and revenues. As such, it also provides key market and customer information for the pursuit of market options and electricity trade opportunities.

***Economic and Demographic Outlook***

Year 2001 began under the shadow of a slowdown in the U.S. economy that began in the second half of 2000. Just as it seemed that a turnaround might be possible, the world was shocked by the terrorist attack in the U.S. on September 11. The incalculable negative impact of the attack has forced governments and central bankers around the world to immediately focus their attention on how to control the damage, and to save the economy from being caught up in a downward spiral.

The assumption is that monetary and fiscal measures brought in through 2001 will encourage more economic activities. However, the resumption of growth is not expected until well into 2002. A North American led recovery is needed to provide the jump-start for more global growth. Since consumer spending in Canada and the U.S. held up reasonably well through 2001, it is unlikely that there is much "pent-up" consumption in North America carried over from the recession. As a result, it is unlikely that further additional consumer spending that could bring about quicker economic growth in Canada and the U.S. will occur in the short term. The manufacturing sector has been hit hard by the downturn and the squeeze on corporate profits was severe in 2001. Fast growth in business investments is unlikely until after capacity that has already been idled by the downturn is being utilized. Many industries are still in a restructuring mode despite low interest rates. Fast growth in employment is also unlikely until after business earnings are allowed to return to an acceptable level.

The BC economy had a worse-than-expected year in 2001 because of its heavy reliance on commodity exports. Growth in BC's service-producing industries in the short term will be affected by two additional factors: decline in tourism and population growth. BC's economy has become more diversified with the addition of more service sector activities. Tourism in particular is a large industry in BC. After the September 11 terrorist attack, tourism and related service industries around the world were hit hard due to aversion to flying and travel in general. BC's population growth was below 1% in recent years, and growth in inter-provincial migration is projected to remain low because of better job prospects outside BC. These trends are expected to continue in the short term, and will limit increase in the demand for services in BC.

An improved economic recovery in Japan would also help BC. However, efforts by the Japanese Government to stimulate its domestic economy have not been very successful so far. Economic growth in Japan is likely to remain sluggish in the short term until confidence in the Japanese domestic financial sector is restored.

### *Electricity Demand Outlook*

Total annual BC Hydro service area sales to residential, commercial, and industrial customers are projected to increase from 46,805 GW.h in 2000/01 to 63,287 GW.h by 2021/22, for an annual growth rate (compound growth rate) of 1.4%.

The residential sector is responsible for 5,688 GW.h of the increase, the commercial sector is responsible for 7,628 GW.h, and the industrial sector is responsible for 3,165 GW.h.

Growth in electricity-intensive industries was a major factor in the increase in electricity demand in BC in the past. This trend is not expected to continue as the shift since the 1990s was towards a more service-based and less electricity-intensive economy.

Projected increases in electricity sales are mainly due to higher distribution electricity sales. BC's population growth is projected to increase from 4.06 million in 2000 to 4.32 million by 2005, to 4.65 million by 2010, and to 5.31 million by 2020. Increases in population will produce more requirements for housing and a larger consumer market, enabling a greater residential and commercial electricity demand.

Increased electricity consumption will come from growing applications of electro-technologies and from more automation in general. The use of technologies at home and to enhance business productivity and competitiveness is expected to continue. Increasing demands to preserve the natural environment and growing pressures from global competition will require BC's resource-based industries to shift to a greater degree of value-added manufacturing. Value-added products will require the substitution and enrichment of valuable raw materials by other inputs, including energy. Productive gains from computerization were credited to be a major factor enabling the high economic growth, low inflation environment that flourished in the 1990s. Automation and computerization would imply the enhancement of labor-intensive input by machinery and computer-based devices, resulting in an increase in energy requirements.

**TABLE ES-1**

**Probable Load Forecast Sales by Sector**

| YEAR | RESIDENTIAL | | COMMERCIAL | | INDUSTRIAL | |
|---|---|---|---|---|---|---|
| | GW.h | Growth Rate | GW.h | Growth Rate | GW.h | Growth Rate |
| 2000/01 | 14,573 | | 13,654 | | 18,579 | |
| 2005/06 | 15,750 | 1.6% | 14,801 | 1.6% | 18,855 | 0.3% |
| 2011/12 | 17,342 | 1.6% | 17,173 | 2.1% | 20,682 | 1.0% |
| 2021/22 | 20,261 | 1.6% | 21,282 | 2.1% | 21,744 | 0.8% |

**Note: Annual growth rates are shown over the 5, 11, and 21 years. The forecast includes the impacts of savings from Power Smart programs activated as of December 2001**

**TABLE ES-2**

**Probable Load Forecast**

| YEAR | TOTAL DOMESTIC SALES | | TOTAL GROSS REQUIREMENTS | | INTEGRATED SYSTEM PEAK | |
|---|---|---|---|---|---|---|
| | GW.h | Growth Rate | GW.h | Growth Rate | MW | Growth Rate |
| 2000/01 | 47,891 | | 53,413 | | 9,319 | |
| 2011/12 | 56,079 | 1.4% | 62,624 | 1.5% | 11,357 | 1.8% |
| 2021/22 | 64,315 | 1.4% | 71,860 | 1.4% | 13,170 | 1.7% |

**Note: Annual growth rates shown for 11 and 21 years. The forecast includes the impacts of savings from Power Smart programs activated as of December 2001.**

***Forecast Uncertainty***

A sensitivity analysis was conducted to derive an uncertainty band for the forecast. Five major causal factors were analyzed to determine the range of forecasts that would have an 80% confidence level of encompassing the actual demand outcome. The high and low annual growth rates over the forecast period were projected to be about 1.8% and 1.1% in gross requirements, respectively. By 2011/12, the difference in gross requirements between the Probable and High forecasts is 2,564 GW.h, and 2,607 GW.h between the Probable and Low forecasts.

**Figure ES-1**

**Total Gross Requirements**

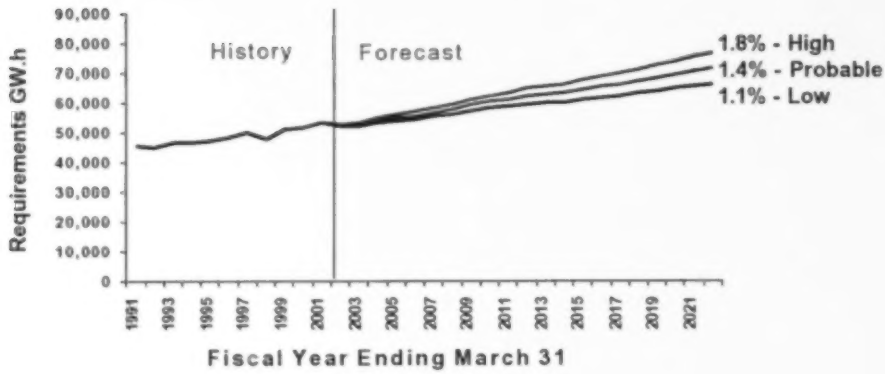
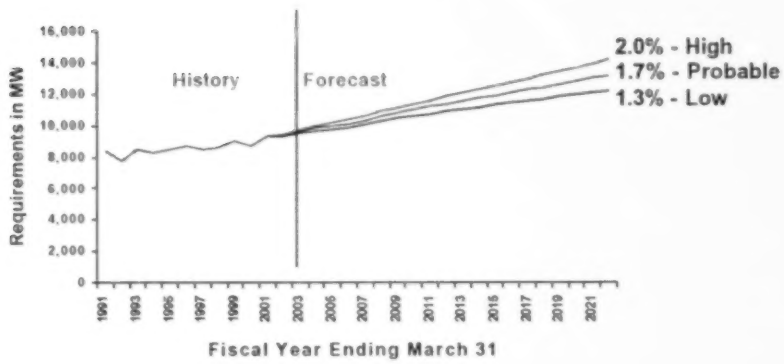



**Figure ES-2**

**Peak Demand Forecast**



# SECTION 1 – INTRODUCTION

### *BC Hydro Service Area Overview*

BC Hydro is the third largest electric utility in Canada, and generates approximately 78% of the electricity consumed in the province of BC. The remainder is generated by industry, primarily forest products, in self-generation facilities; by Alcan at its Kemano plant; by Utilicorp Networks Canada and by Cominco in the south-central portion of the province; and by a few small facilities outside BC Hydro's grid.

Over 94% of BC's 4.1 million population reside in BC Hydro's service area. That translates into more than 1.6 million residential, commercial, and industrial customer accounts.

Electricity is provided primarily by BC Hydro's 11,133 MW installed capacity, 90% of which is hydroelectric-based, and delivered to customers over more than 75,263 km of transmission and distribution power lines. In the 2000/2001 fiscal year (April 2000 to March 2001), including electricity trade, 72,031 GW.h of electricity were sold, providing revenue of 7,889 million dollars.

### *Purpose of the Forecast*

The electric load forecast is one of the key drivers of BC Hydro's planning activities. The primary purpose of the electric load forecast is to address the key questions of "when, where, why, and how much" electricity will be required on the BC Hydro system to allow BC Hydro to evaluate planning alternatives, as well as to provide a basis for forecasting domestic revenues. With the advent of restructuring in the North American electricity market, the forecast of domestic requirements is an input that enables the pursuit of future market options and electricity trade decisions.

This document outlines the major assumptions, and information sources used to forecast total electricity sales to customers served by BC Hydro. This report has ten sections plus a Glossary and an Appendix.

The sections are as follows:

***Section 1***

*Introduction*

***Section 2***

*Probable Electricity Requirements* presents the forecast in summary form for readers not interested in sectoral detail.

***Section 3***

*Economic and Demographic Outlook* describes economic and population assumptions used to update the forecast.

***Sections 4, 5 and 6***

*Residential Sales, Commercial Sales and Industrial Sales* contain assumptions used in preparing the sectoral energy forecasts.

***Section 7***

*Regional Peak Forecast* explains the regional economic forecasts and the peak demand forecasts at the system and the regional level.

Factors influencing peak demand uncertainties and opportunities will have major planning implications. Increasingly, the focus of the forecast will be extended to make available information on load requirements to meet the diverging needs of all internal users and to enable the foundation for the pursuit of business options, strategies and plans.

***Section 8***

*Forecast Process and Methodology* describes the approach used in developing the Probable Forecast, including the iterative process employed in evaluating the impact of the load forecast on Hydro's supply, demand, and financial planning functions.

***Section 9***

*Marketing and Power Smart* discusses the present status of BC Hydro's marketing and demand-side management programs and the methods used to incorporate them into the load forecast.

***Section 10***

*Forecast Uncertainty and Sensitivity Analysis* explains the analysis of the uncertainty band around the probable energy and peak demand forecasts; discusses the weather sensitivity of peak demands; and describes scenario analyses.

***Glossary***

A *glossary* of terms and terminology used in this report.

***Appendix***

The *appendix* includes a detailed table of energy forecasts.

# SECTION 2 – PROBABLE ELECTRICITY REQUIREMENTS

***2000/01 Sales***

Total system billed sales for the 12 months ending March 2001 were 48,204 GW.h.

Compared to total system billed sales for the preceding fiscal year (April 1999 to March 2000), residential sales increased by 1 GW.h, commercial sales increased by 477 GW.h, and industrial sales increased by 689 GW.h.

Compared to the sales forecast for the 2000/01 fiscal year, total billed sales were 0.3% above forecast: residential sales were 2.9% below forecast, commercial sales were 1.0% below forecast, and industrial sales were 3.2% above forecast.

***Sales and Gross Requirements***

The probable electricity forecast includes electricity sales in BC Hydro's integrated and non-integrated service areas, plus domestic inter-utility and firm export commitments. Interruptible export sales and Powerex sales are excluded.

Domestic inter-utility commitments include sales forecasts for customers in BC presently not served by BC Hydro.

Firm exports include sales under contractual agreements to customers outside BC.

(a) **Total Sales to BC Hydro Service Area**

Total annual BC Hydro service area sales to residential, commercial, and industrial customers are projected to increase from 46,805 GW.h in 2000/01 to 63,287 GW.h by 2021/22, for an annual growth of 1.4%.
The residential sector is responsible for 5,688 GW.h of the increase, the commercial sector is responsible for 7,628 GW.h, and the industrial sector is responsible for 3,165 GW.h.

(b) **Total Domestic Inter-Utility Sales and Firm Export Sales**

Domestic inter-utility sales are forecast to decrease by 57 GW.h for an annual growth rate of -0.3% over 21 years.

Firm export sales are forecast to increase at an annual rate of 0.1% over the 21 years.

(c) **Total Firm Sales**

Total firm sales are projected to increase from 48,204 GW.h in 2000/01 to 64,635 GW.h in 2021/22 for an annual growth rate of 1.4%.

### (d) Gross Energy and Capacity Requirements

Total gross generation requirements are projected to increase from 53,413 GW.h in 2000/01 to 71,860 GW.h in 2021/22 for an annual growth of 1.4%.

Figure 2-1, Probable Gross Energy Requirements, summarizes the gross energy forecast by sector for BC Hydro.

Table 2-1 on the following page, provides more detail on this forecast.

Integrated system capacity requirements are projected to increase from a system peak of 9,319 MW in 2000/01 to 13,170 MW in 2021/22, for an annual growth rate of 1.7%.

**FIGURE 2-1**

**Probable Gross Energy Requirements**

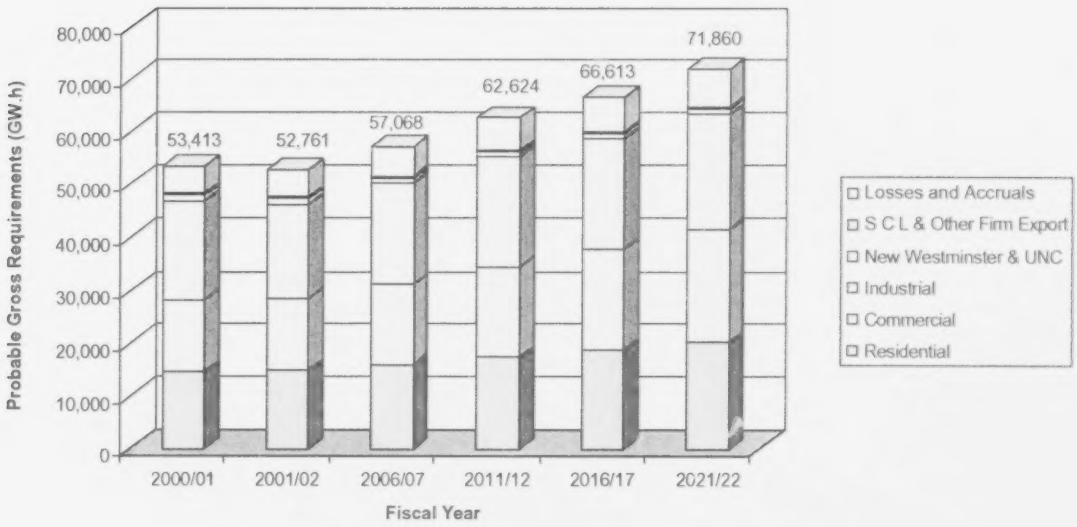


TABLE 2-1

BC HYDRO PROBABLE GROSS LOAD REQUIREMENTS BY MAJOR SECTORS
(Including SCL & UNC)

| | | | | | | | | | | | INTEGR. SYSTEM | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fiscal Year | Residential Sales (GW.h) | Commercial Sales (GW.h) | Industrial Sales (GW.h) | UNC Sales (GW.h) | SCL Sales (GW.h) | Other Sales (GW.h) (1) | Total Firm Sales (GW.h) (2) | Losses and Accrual (GW.h) | Total Gross Requirements (GW.h) | Less Non-Integr. (GW.h) | Total Gross Requirements (GW.h) | Peak (MW) |
| **Actual** | | | | | | | | | | | | |
| 1996/97 | 13,983 | 12,168 | 17,447 | 66 | 319 | 379 | 44,362 | 5,923 | 50,285 | 256 | 50,030 | 8,455 |
| 1997/98 | 13,802 | 12,466 | 16,339 | 95 | 312 | 370 | 43,384 | 4,958 | 48,342 | 247 | 48,095 | 8,566 |
| 1998/99 | 13,972 | 12,814 | 18,077 | 272 | 289 | 381 | 45,805 | 5,505 | 51,310 | 248 | 51,061 | 9,026 |
| 1999/00 | 14,572 | 13,177 | 17,890 | 366 | 311 | 375 | 46,691 | 5,255 | 51,946 | 255 | 51,691 | 8,646 |
| 2000/01 | 14,573 | 13,654 | 18,579 | 719 | 310 | 370 | 48,204 | 5,209 | 53,413 | 264 | 53,148 | 9,319 |
| **Forecast** | | | | | | | | | | | | |
| 2001/02 | 14,833 | 13,723 | 17,656 | 629 | 316 | 381 | 47,539 | 5,222 | 52,761 | 269 | 52,492 | 9,398 |
| 2002/03 | 15,042 | 13,913 | 17,462 | 540 | 316 | 382 | 47,656 | 5,251 | 52,907 | 271 | 52,635 | 9,615 |
| 2003/04 | 15,285 | 14,173 | 18,410 | 420 | 318 | 383 | 48,989 | 5,381 | 54,370 | 274 | 54,096 | 9,788 |
| 2004/05 | 15,529 | 14,493 | 18,596 | 400 | 316 | 384 | 49,718 | 5,466 | 55,184 | 277 | 54,907 | 9,946 |
| 2005/06 | 15,750 | 14,801 | 18,855 | 416 | 316 | 385 | 50,522 | 5,556 | 56,078 | 280 | 55,798 | 10,100 |
| 2006/07 | 15,987 | 15,169 | 19,112 | 440 | 316 | 387 | 51,412 | 5,656 | 57,068 | 283 | 56,785 | 10,284 |
| 2007/08 | 16,240 | 15,545 | 19,532 | 449 | 318 | 389 | 52,472 | 5,772 | 58,244 | 285 | 57,959 | 10,561 |
| 2008/09 | 16,506 | 15,941 | 20,083 | 458 | 316 | 391 | 53,695 | 5,903 | 59,598 | 288 | 59,310 | 10,790 |
| 2009/10 | 16,782 | 16,346 | 20,332 | 467 | 316 | 393 | 54,635 | 6,012 | 60,647 | 291 | 60,356 | 10,976 |
| 2010/11 | 17,058 | 16,771 | 20,473 | 476 | 316 | 395 | 55,490 | 6,116 | 61,606 | 293 | 61,312 | 11,165 |
| 2011/12 | 17,342 | 17,173 | 20,682 | 486 | 318 | 400 | 56,401 | 6,223 | 62,624 | 296 | 62,328 | 11,357 |
| Annual Growth Rate % | | | | | | | | | | | | |
| Incr. 11 years: | | | | | | | | | | | | |
| 00/01-11/12 | 1.6% | 2.1% | 1.0% | -3.5% | 0.2% | 0.7% | 1.4% | 1.6% | 1.5% | 1.0% | 1.5% | 1.8% |
| 2012/13 | 17,627 | 17,606 | 20,400 | 495 | 316 | 404 | 56,848 | 6,294 | 63,142 | 299 | 62,843 | 11,528 |
| 2013/14 | 17,916 | 18,011 | 20,115 | 505 | 316 | 408 | 57,271 | 6,361 | 63,632 | 302 | 63,330 | 11,703 |
| 2014/15 | 18,208 | 18,407 | 20,314 | 516 | 316 | 412 | 58,172 | 6,476 | 64,639 | 305 | 64,333 | 11,888 |
| 2015/16 | 18,504 | 18,781 | 20,506 | 526 | 318 | 416 | 59,051 | 6,570 | 65,621 | 308 | 65,312 | 12,065 |
| 2016/17 | 18,797 | 19,163 | 20,706 | 536 | 316 | 420 | 59,939 | 6,674 | 66,613 | 312 | 66,301 | 12,555 |
| 2017/18 | 19,093 | 19,554 | 20,906 | 547 | 316 | 424 | 60,840 | 6,780 | 67,620 | 315 | 67,305 | 12,436 |
| 2018/19 | 19,388 | 19,954 | 21,111 | 558 | 316 | 428 | 61,755 | 6,887 | 68,642 | 318 | 68,325 | 12,614 |
| 2019/20 | 19,681 | 20,381 | 21,314 | 569 | 318 | 432 | 62,695 | 6,997 | 69,692 | 321 | 69,372 | 12,803 |
| 2020/21 | 19,974 | 20,826 | 21,523 | 581 | 316 | 436 | 63,655 | 7,110 | 70,765 | 323 | 70,441 | 12,987 |
| 2021/22 | 20,261 | 21,282 | 21,744 | 592 | 316 | 440 | 64,635 | 7,225 | 71,860 | 326 | 71,534 | 13,170 |
| Annual Growth Rate % | | | | | | | | | | | | |
| Incr. 10 yrs: | | | | | | | | | | | | |
| 11/12-21/22 | 1.6% | 2.2% | 0.5% | 2.0% | -0.1% | 1.0% | 1.4% | 1.5% | 1.4% | 1.0% | 1.4% | 1.5% |
| Annual Growth Rate % | | | | | | | | | | | | |
| Incr. 21 years: | | | | | | | | | | | | |
| 00/01-21/22 | 1.6% | 2.1% | 0.8% | -0.9% | 0.1% | 0.8% | 1.4% | 1.6% | 1.4% | 1.0% | 1.4% | 1.7% |

**Notes:**

1. Inter-Utility transfers (excluding Utilicorp Networks Canada UNC (formerly WKP) ) and firm export (excluding Seattle City Light (SCL) ).

2. Interruptible Marketing (E+) and Demand Side Management (DSM) programs included in Actual and in Forecast numbers.

# Section 3 – ECONOMIC AND DEMOGRAPHIC OUTLOOK

Year 2001 began under the shadow of a slowdown in the U.S. economy that began in the second half of 2000. The hope at the beginning of the year was that a recovery might occur after a mild slowdown in the first half of 2001. It became obvious as the year progressed that the downward momentum was very strong, that the threat of a global recession loomed increasingly larger. Just as it seemed that a turnaround might be possible, the world was shocked by the terrorist attack in the U.S. on September 11. The incalculable negative impact of the attack has forced governments and central bankers around the world to immediately focus their attention on how to control the damage, and to save the economy from being caught up in a downward spiral. The September 11 terrorist attack effectively dragged the economy into a new trough, shattering any chance of an economic rebound in 2001.

The economic downturn that started in 2000 was the result of a deliberate plan engineered by the powerful U.S. Federal Reserve to cool the U.S. domestic economy. Consecutive increases in interest rates were employed in 2000 to reduce consumption and discourage investments. It marked the completion of nine years of continuous growth, and the longest post-war economic growth cycle in the U.S. It was not until November 2001 that the U.S. National Bureau of Economic Research finally reached the conclusion that the U.S. recession actually began in March 2001. However, signs of an economic slowdown were painfully clear since the beginning of the year as stock markets continued to fall, manufacturing sectors began to accumulate inventories, and unemployment started to rise. Although the squeeze on corporate profits was severe, the slowdown did not spread evenly across the economy. Consumer spending held up reasonably well through the year while business investment and manufacturing activities declined. Investments in high tech equipment and services were hit particularly hard because of past over-investment.

***Short Term***

The U.S. is the largest trading partner of Canada. Therefore, the performance of the Canadian economy in 2002 will continue to depend to a large extent on economic events unfolding in the U.S. Economic growth came to an abrupt halt right after the September 11 terrorist attack. But much of the activity began to return to normal soon after. With the exception of industries that are connected to transportation and tourism, the impact of the economic disruption was not evident towards the end of the year. However, adding to economic uncertainty are concerns over security and terrorism, resulting in much negative impact on the general business climate. As such, there are still many challenges to be overcome before the economy can be expected to resume growth.

The assumption is that monetary and fiscal measures brought in through 2001 will encourage more economic activities. Interest rates were on a decline since the beginning of 2001. To minimize economic disruption since the September 11 attack, central banks in the U.S., Canada and around the world have injected large doses of monetary stimulus into financial markets to ensure that the economy will continue to operate smoothly. As a result, interest rates were at a 40-year low by the end of 2001. On the fiscal side, the economy should also benefit from tax cuts as well as from increased government spending.

In Canada, income and corporate taxes have generally been on a decline at both the Federal and Provincial levels. In the U.S., the Federal Government has also pledged to support the economy in the form of increased defense spending, assistance for industries hard hit by the September 11 attack, and tax rebates. These measures are expected to have a positive impact on the economy.

However, the resumption of growth is not expected until well into 2002. Economies around the world have slowed dramatically over the last year. Europe is fighting its own recession. Japan has remained in its decade-long slump, and other emerging economies are struggling with their own economic problems. Because foreign markets are not expected to provide much demand for North America's exports in the short term, the challenge to revive global economic growth will have to start to a large extent with an increase in domestic consumption in Canada and the U.S. In other words, a North American led recovery is needed to provide the jump-start for more global growth. Since consumer spending in Canada and the U.S. held up reasonably well through 2001, it is unlikely that there is much "pent-up" consumption in North America carried over from the recession. As a result, it is unlikely that further additional consumer spending that could bring about quicker economic growth in Canada and the U.S. will occur in the short term. The manufacturing sector has been hit hard by the downturn and the squeeze on corporate profits was severe in 2001. Fast growth in business investments is unlikely until after capacity that has already been idled by the downturn is being utilized. Many industries are still in a restructuring mode despite low interest rates. Fast growth in employment is also unlikely until after business earnings are allowed to return to an acceptable level.

The BC economy had a worse-than-expected year in 2001 because of its heavy reliance on commodity exports and tourism. The U.S. is the largest market for BC's resource-based exports, purchasing about 55% of BC's wood products, about 50% of BC's newsprint, and about 25% of BC's pulp, paper and paperboard. The total value of all exports from BC to the U.S. is equivalent to about 70% of BC's international exports. Japan is second at about 15%. BC's resource-based exports will benefit from an U.S. led economic recovery. The expectation is that some improvement compared to 2001 will occur through the course of 2002. A strengthening housing sector in the U.S. will create a higher demand for lumber, and an increase in business activity will lead to more advertising and requirements for more pulp and paper. An improved economic recovery in Japan would also help BC. However, efforts by the Japanese Government to stimulate its domestic economy have not been very successful so far. Economic growth in Japan is likely to remain sluggish in the short term until confidence in the Japanese domestic financial sector is restored.

Growth in BC's service-producing industries in the short term will be affected by two additional factors: decline in tourism and population growth. BC's economy has become more diversified with the addition of more service sector activities. Tourism in particular is a large industry in BC. After the September 11 terrorist attack, tourism and related service industries around the world were hit hard due to aversion to flying and travel in general. The impact on the BC tourism industry in the fourth quarter of 2001 was significant. Population growth was the main factor supporting BC's economic performance through the economic downturn in the early 1990s. However, BC's population growth was below 1% in recent years, and growth in inter-provincial migration is projected to remain low because of better job prospects outside BC. These trends are expected to continue in the short term, and will limit increase in the demand for services in BC.

### *Long Term*

In the long term, BC's population is expected to grow at a rate higher than the national average because of assumptions such as an increase in the number of retirees, more international immigrants, and lifestyle related benefits. BC's warmer climate has traditionally been very attractive to retirees and to people from other Canadian provinces and for international immigrants. Desire for outdoor activity and the natural environment also means that younger Canadians, given an equal job opportunity, will prefer to settle in BC for lifestyle reasons.

Economic growth and improved literacy are expected to generate a much larger relative growth in demand for resource-based products in many developing economies. As a result, BC is expected to benefit from an expanding international market for commodity products.

BC is also well positioned to benefit from emerging business opportunities in the Asian market in particular. Growth in the Pacific Rim region will enable BC to become one of North America's major communication and transportation links because of its proximity.

# SECTION 4 - RESIDENTIAL SALES

***General***

Residential sales are forecast to grow from 14, 573 GW.h in 2000/01 to 15, 750 GW.h in 2005/06, to 17,342 GW.h in 2011/12, and to 20,261 GW.h in 2021/22. These increases represent annual growth rates of 1.56% over the next 5 years (2000/01 to 2005/06), and 1.59% over the next 11 years (2000/01 to 2011/12).

Forecast growth rates in this forecast are similar to those in the previous forecast. Both forecasts assumed weather based on a rolling 10-year normal, while previous forecasts were based on a fixed 30-year normal (1961-1990) provided by Environment Canada.

The two main drivers of the residential forecast are the forecast of number of residential accounts, and the forecast of use rate (annual electricity consumption per residential account).

Over the ten-year period between 1990/91 and 2000/01, the annual increase in weather normalized residential sales was 2.2%. Future population growth in BC is projected to be lower than it was in the past due to lower economic growth. In addition, the use rate is not expected to continue growing as fast as it did in the past. Therefore growth in residential electricity sales is projected to be lower than before.

***Number of Accounts***

At the end of the 2000/01 fiscal year, BC Hydro served 1,411,330 residential accounts. In the short term, growth in the number of residential accounts is based on the population forecast provided by BC Stats, Ministry of Finance and Corporate Relations, and also on regional economic forecasts. Over the next five years, the number of residential accounts is projected to grow to 1,502,859 at the end of the 2005/06 fiscal year, which corresponds to an annual growth rate of 1.26%. This compares with the population growth forecast of 1.24% provided by the BC Stats.

In the long term, the forecast for the number of residential accounts is driven mainly by the population forecast provided by BC Stats. The population in the BC Hydro service area is projected to grow from 3.71 million in 2000 to 4.30 million in 2011, and to 4.89 million by 2021. These increases represent annual growth rates of 1.35% over the next eleven years, and 1.33% over the next twenty-one years. The corresponding growth rates for the number of residential accounts are 1.39% and 1.37% respectively.

***Use Rate***

The use rate forecast is based on projections of factors such as housing mix (single family, row house, apartment, etc.), heating fuel choices (electric versus non-electric), appliance penetration rates, appliance lifespans and changes in electricity demands.

Currently, 20% of residential accounts are heated electrically, and on average they require 14,075 kW.h per year. Unless regulations or new laws are introduced, this share will likely increase, although the average usage may not change much.

Ten years ago, weather normalized use rate was 10,325 kW.h per year, and increasing by about 200 kW.h per year. However, in the last five years, growth in the use rate has been declining, with use rate currently remaining almost constant at 10,425 kW.h per year. Improvements in building insulation and appliance efficiency

are the main reasons for the lack of growth in the annual residential use rate.

Over the longer term, use rate is not expected to change much because of the offsetting effects of the following residential trends:

- Space Heating: increased electric market share versus smaller housing units.

  Due to limited availability of land for residential development, the trend in major metropolitan centres is expected to be towards denser housing. Since row houses and apartments are more likely to be built with electric heat than single family homes, the market share for electrically heated housing is expected to increase.

  Although new row houses and apartments tend to be larger than existing similar dwellings, they are generally smaller in size than single family homes, and therefore have lower space heating load requirements.

  The increase in market share of electric space heating is also offset to some extent by improvements in building standards, and by the construction of the Vancouver Island gas pipeline which has made gas space heat available to Island residents.

  However, natural gas prices are projected to be higher for Vancouver Island compared to the Mainland over the entire forecast period. As a result, the growth in the penetration rate of gas heating is anticipated to be slower for Vancouver Island than it was for the Mainland.

- More efficent appliances versus higher penetration.

  Manufacturers throughout Canada and the United States are expected to continue to improve the energy efficiency of major electrical appliances. As older models wear out and are replaced by newer ones, electricity consumption for major appliances such as refrigerators, freezers, ovens, and ranges is forecast to decrease.

  However, new models of these major appliances tend to be larger than models currently in use. Some of the reduction in electricity use resulting from improvements in electricity efficiency will be offset by an increase in appliance size.

- A projected decrease in the number of people per household would tend to reduce electricity use per account.

  However, this reduction is expected to be offset by an increase in the penetration level of small appliances.

  An increase in electricity use is also projected from lifestyle changes and technological improvements. The latter are expected to cause an increase in demand for electronic, entertainment and telecommunication devices in the home. A trend towards home offices is also expected to increase residential electricity consumption in the long term.

  In the long term, the expected overall impact of these various trends is that the factors working to increase the use rate will be offset by the factors working to decrease it, leading to the use rate leveling off.

***Residential Sales Forecast***

To develop the residential sales forecast for the entire BC Hydro service area, the total service area was divided into four customer service regions, and a forecast was prepared for each region. These regions are: Lower Mainland; Northern Region; South Interior; and Vancouver Island.

For each region, a housing stock forecast was prepared based on the regional number of residential accounts forecast, and on other regional factors such as trends in housing mix and gas availability.

A use rate forecast was also developed for each region based on projections of penetration rates and individual consumption levels by end use (space heating, water heating, major appliances, and small lifestyle appliances).

The residential sales forecast for a region is the sum of the requirements for each end use. The requirements for each end use are the product of the number of accounts having that end use and the energy used by an average account having that end use.

**FIGURE 4-1**
**Residential Use Breakdown**

**FIGURE 4-2**
**Residential Trends**

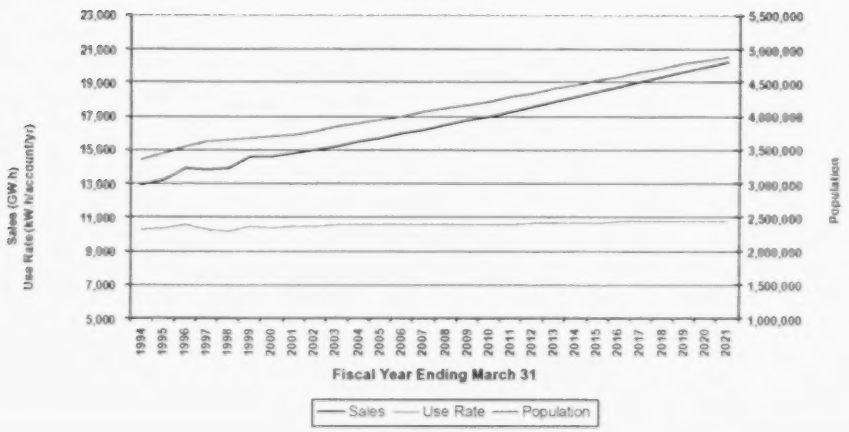


TABLE 4-1

RESIDENTIAL ELECTRIC SALES FORECAST
By Region

| Fiscal Year | Lower Mainland (GW.h) | Northern Region (GW.h) | South Interior (GW.h) | Vancouver Island (GW.h) | Total Sales (GW.h) |
|---|---|---|---|---|---|
| **Actual** | | | | | |
| 1996/97 | 7,158 | 1,427 | 1,553 | 3,845 | 13,983 |
| 1997/98 | 7,187 | 1,378 | 1,518 | 3,719 | 13,802 |
| 1998/99 | 7,355 | 1,357 | 1,541 | 3,718 | 13,972 |
| 1999/00 | 7,670 | 1,409 | 1,583 | 3,909 | 14,571 |
| 2000/01 | 7,695 | 1,397 | 1,617 | 3,863 | 14,573 |
| **Forecast** | | | | | |
| 2001/02 | 7,803 | 1,437 | 1,657 | 3,936 | 14,833 |
| 2002/03 | 7,911 | 1,458 | 1,685 | 3,989 | 15,042 |
| 2003/04 | 8,041 | 1,481 | 1,717 | 4,046 | 15,285 |
| 2004/05 | 8,173 | 1,503 | 1,749 | 4,103 | 15,529 |
| 2005/06 | 8,287 | 1,522 | 1,778 | 4,162 | 15,750 |
| 2006/07 | 8,411 | 1,542 | 1,809 | 4,225 | 15,987 |
| 2007/08 | 8,541 | 1,564 | 1,840 | 4,294 | 16,240 |
| 2008/09 | 8,680 | 1,586 | 1,873 | 4,367 | 16,506 |
| 2009/10 | 8,824 | 1,609 | 1,906 | 4,443 | 16,782 |
| 2010/11 | 8,968 | 1,631 | 1,939 | 4,521 | 17,058 |
| 2011/12 | 9,114 | 1,653 | 1,973 | 4,602 | 17,342 |
| Annual Growth Rate % incr.11 years: 00/01-11/12 | 1.6% | 1.5% | 1.8% | 1.6% | 1.6% |

# SECTION 5 - COMMERCIAL SALES

***General***

The 2001 commercial sector forecast reflects a change in BC's economic outlook compared to what was anticipated last year. In the 2000 commercial forecast, the outlook was that the economy was at the beginning of a gradual recovery. In contrast, the events of last year, such as the softening of the US and global economies, and restructuring of the provincial economy, have contributed to a longer turnaround period than previously expected.

Electricity sales to BC Hydro's commercial sector were strong in 2000/01, growing by 3.6% over the year. This was slightly higher than last year's forecast of 3.0% and considerably higher than the anticipated 0.5% growth for fiscal year 2001/02.

As the economy begins to regain momentum the annual growth rates are expected to increase to 1.6% over the first 5 years of the forecast period and 2.1% over 11 years. This results in an increase from 13,654 GW.h in 2000/01 to 14,800 GW.h in 2005/06 and 17,173 GW.h in 2011/12.

It is expected that sales to the commercial sector will continue to grow faster than sales to the industrial sector over the long term as a result of the continuing trend in BC towards a more service-based economy. In 2000/01, commercial sales accounted for 28.5% of BC Hydro's domestic sales. This share is forecast to increase to about 33.0% by 2021/22.

The commercial sector is generally subdivided into five major subsectors:

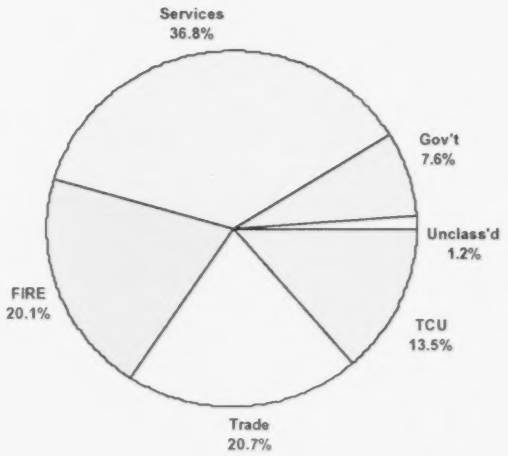
- Transportation, Communications and Other Utilities (TCU)
- Wholesale and Retail Trade (Trade)
- Finance, Insurance and Real Estate (FIRE)
- Community, Business and Personal Services (Services)
- Government Services (Gov't)

Any customers not included in these subsectors are grouped into one subsector called "Unclassified".

**Figure 5-1**

**BC Hydro Commercial Sub-Sector Sales Split**

Figure 5-1 outlines the relative consumption between each of these sub-sectors in 2000/01.



***Methodology and Major Trends***

BC Hydro's commercial sector forecast is primarily an end-use or bottom-up forecast. That is, it is a forecast that focuses on the demand for energy consuming end-uses (i.e. heat, light, and refrigeration) to meet the requirements for commercial buildings. In its simplest form, the forecast is the product of the commercial sector building floorstock (i.e. the floor area in square meters) and the intensity of end-use demand per unit floorstock. BC Hydro's forecast disaggregates commercial buildings in the province into 13 building types (i.e. hospitals, retail, offices, hotels, etc.) and up to 10 different end-uses (i.e. space heating, lighting, hot water, HVAC, etc.).

The growth of commercial floorstock is dependent on many different factors including economic trends, population growth, demographics and labour markets. For example, an aging population will require an increased number of health care facilities and growth in the tourism sector will be reflected in the number of hotels, restaurants and recreation facilities.

The intensity of end-use demand will change with factors such as the turnover of building stock and the evolution of the technology that produces the end-use. As an example, newer buildings will have more efficient lighting and HVAC systems. In addition, new loads can be introduced that put an upward pressure on energy consumption (i.e. greater lighting levels in retail stores or an increased use of computers).

The BC economy continues to be strongly influenced by the primary resource industries and their associated international markets. BC's service sector has however been growing significantly in recent years and it now employs three times the number of people as the goods sector. As a result the service sector has been the primary employment growth engine for the province and this trend is expected to continue.

In 2000 BC's population grew by a mere 0.9%, slightly higher than the 0.8% in 1999, and a significant contrast to the strong growth rates observed in the 1980s and early 1990s. In the next few years it is anticipated that with the improving economy migration will once again favor BC, reversing recent trends of people leaving BC to find work in other provinces. It is not expected, however, that migration levels will return to previous highs.

Commercial sales were strong in 2000/01 with growth of 478 GW.h over the year (3.6%) compared to a more typical annual growth of 362 GW.h in 1999/00 (2.8%). This strong performance was also evident in the employment figures for BC's service industries, which were considerably stronger in 2000 than in 1999. The latter part of 2001 has however seen these rates decline dramatically.

All subsectors demonstrated increased growth in 2000/01. Some anomalies have shown up in the Services subsector, which show declines in sales to restaurants, amusement and recreation, and administrative services. Many of these are a result of accounting corrections that have moved some accounts to other sectors, including Government Services.

The current economic climate has had a significant impact on electricity sales to the commercial sector. It is anticipated that by the end of fiscal year 2001/02, commercial sector sales will grow by only 69 GW.h to 13,723 GW.h. This growth is forecast to increase to 190 GW.h in 2002/03 and 260 GW.h in 2003/04. In the first 5 years of the forecast period (to 2005/06) the annual growth rate is anticipated to be 1.6%, increasing to 2.1% over the long-term.

This long-term growth has decreased from what was anticipated in last year's forecast due to the slower growth expected for the first couple of years. Electricity sales growth in the services sector is likely to bounce back as the economy strengthens and consumer spending continues to improve.

The long-term commercial sales growth will be driven by factors including:

- a growing population, which increases the demand for most general services;
- an aging population, which will require increased heath care services;
- increases in electric intensity, a result of greater use of electronic and information end-use technologies;
- continued growth in the tourism sector;
- new electricity-using technologies becoming more common in commercial establishments;
- continued growth of Vancouver as an international finance centre;
- BC's continued role as Canada's link with Pacific markets; and,
- the potential for development of a high tech sector within the province.

***Subsector Summaries***

**Transportation Communication and Other Utilities (TCU)**

In 2000/01 TCU grew by 1.1% from 1,822 GW.h in 1999/00 to 1,841 GW.h. The subsector is comprised mainly of transportation facilities, grain elevators, radio and television broadcasting, water and telephone systems. Pipeline transport was the most significant contributor to this growth, a result of increased production and delivery of gas to markets within Canada and the U.S. Construction of gas gathering, cleaning, transmission and distribution facilities are growing and expected to remain high. The completion of the new terminal building at the Vancouver International Airport, development of the new light rail transit (LRT) system in the Broadway corridor and the subsequent extension of Skytrain to other Lower Mainland suburban areas are also expected to contribute to increased sales to this sector.

Sales to this subsector are forecast to increase at an annual growth rate of 1.3% in the first 5 years of the forecast, increasing to 1.5% over 11 years.

**Wholesale and Retail Trade (Trade)**

Last year total sales to the Trade subsector increased by 3% from 2,749 GW.h in 1999/00 to 2,832 GW.h in 2000/01. This increase in sales was due primarily to increases in retail trade, a result of the mounting consumer confidence before the mid 2001 economic slowdown started to take effect.

Electricity sales in this sector benefit during periods of stable population growth, due to increases in the demand for non-food and food retail space. As such, the current economic downturn is expected to soften sales growth in the sector over the short-term. In the long-term, the subsector is projected to increase its share of total commercial electricity sales because of increasing trade activities needed to support both a growing population and increased tourism. This sector should also benefit from low interest and inflation rates resulting in more wholesale and retail activities and commercial construction.

Sales to this subsector are forecast to increase at an annual growth rate of 1.5% in the first 5 years of the forecast period and increasing to 2.0% over 11 years.

**Finance, Insurance and Real Estate (FIRE)**

In terms of the contribution to GDP, FIRE is the largest and most important service industry. FIRE is however, less labour intensive than other subsectors. Office buildings account for approximately 65% of electricity sales to this subsector. Sales to this subsector have grown steadily for the past five years despite the trend towards continued energy efficiency improvements in office buildings. The full impact of improved efficiency appears to be offset to some degree by continued increases in the use of office automation and information technology, and a steady growth in the number of commercial office buildings.

Employment levels are a good indicator of the demand for commercial office space. A drop in employment will result in excess office space and little new office construction. The recent trend in BC is for lower employment levels and hence lower office building stock growth is anticipated in the first part of the forecast, but improving over the long-term. As would be expected, this trend varies between regions with the Lower Mainland being somewhat less susceptible to the influences of international resource markets.

Provincial government fiscal restraint will also have an impact in this sector, particularly in Southern Vancouver Island. Over the medium-term a stabilization of resource prices and an improving U.S. economy will return sales to more typical levels.

Sales to this subsector are forecast to increase at an annual growth rate of 1.5% in the first 5 years increasing to 2.2% in 11 years.

**Community Business and Personal Services(Services)**

The services subsector is a very diverse group, consisting of establishments such as schools, hospitals, hotels, restaurants, personal services (i.e. barbers and beauty shops) and religious organizations. This sector is susceptible to variables such as changes in population and demographics, which will dictate the demand for institutional buildings (i.e. hospitals and educational facilities) and fluctuations in consumer confidence, which will impact discretionary spending on items like restaurants and travel.

Electricity sales to this sector increased from 4,896 GW.h in 1999/00 to 5,031 GW.h in 2000/01, a growth of 2.8 %. These increases were evident across almost the whole subsector.

In the short-term, provincial fiscal restraint combined with a sluggish economy and a lower level of population growth may impact the provision of some services through the postponement of some institutional facilities. A growing and aging population will however necessitate the construction of new facilities in the education and health components of the sub-sector.

Many of the facilities within this subsector depend heavily on tourism. The tourism industry has been a significant and growing contributor to the BC economy. The health of the industry is impacted by the economic health of other countries and their relative exchange rates. In past years the "Asian Flu" has had a negative impact on visitors from Japan but, at the same time, the low Canadian dollar has encouraged visitors from the U.S. It is expected that these areas will improve over the medium term as the economy in Canada and the U.S. returns to more typical levels.

Sales to this subsector are forecast to increase at an annual growth rate of 1.8% in the first 5 years increasing to 2.2 % over the longer term.

**Government Services (Gov't)**

The entire range of government services, from federal institutions to foreign government agencies, are included in this subsector.

Sales to the government sector in 2000/01 show significant growth. Much of this apparent growth is a result of the movement of accounts from other sectors.

This subsector's share of total commercial sales is expected to continue to decline as governments at all levels strive to reduce their budget further by controlling spending and restricting expansion.

Sales to this subsector are forecast to increase at an annual growth rate of 1.8% in the first 5 years of the forecast period, increasing to an annual growth of 2.5% over 11 years.

**Unclassified**

The Unclassified subsector consists primarily of commercial establishments that are not coded with a North American Industry Classification (NAIC) or Standard Industrial Classification (SIC) code. There were about 7,800 customers in this group at the end of 2000/01 fiscal year and accounted for about one percent of commercial sales.

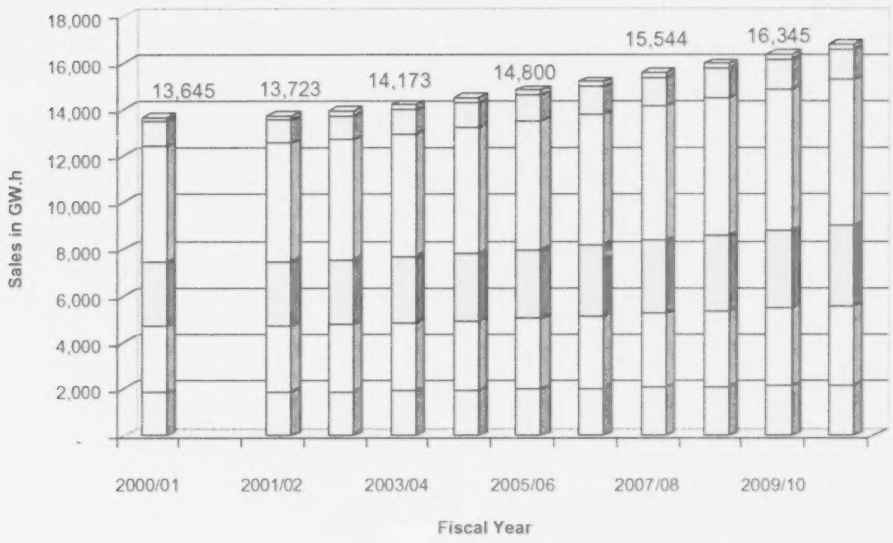
Sales to the unclassified subsector were slightly lower than expected in 2000/01, partially due to the higher than expected increased in 1999/00.

Sales to this subsector are forecast to continue to grow at rates similar to the historical average.

Figure 5-2 summarizes the commercial sales forecast by sector and Table 5-1 details the commercial sales forecast by sector over the forecast period.

FIGURE 5-2

**Commercial Sales by Major Sub-Sector**




**Notes:**

TCU – Transportation, Communication and Utilities
Trade – Wholesale and Retail Trade
FIRE – Finance, Insurance and Real Estate
Services – Community, Business and Personal Services
Gov't – Public Administration and Defense.

## TABLE 5-1

### BC Hydro Commercial Electric Sales Forecast
### By Major Sub-Sector
### (Includes Transmission Customers)

| Fiscal Year | TCU (GW.h) | Trade (GW.h) | FIRE (GW.h) | Services (GW.h) | Gov't (GW.h) | Unclass'd (GW.h) | TOTAL (GW.h) |
|---|---|---|---|---|---|---|---|
| **Actual** | | | | | | | |
| 1996/97 | 1,728 | 2,637 | 2,561 | 4,303 | 755 | 184 | 12,168 |
| 1997/98 | 1,790 | 2,699 | 2,613 | 4,408 | 780 | 175 | 12,466 |
| 1998/99 | 1,827 | 2,798 | 2,654 | 4,555 | 805 | 174 | 12,814 |
| 1999/00 | 1,822 | 2,749 | 2,663 | 4,896 | 851 | 195 | 13,176 |
| 2000/01 | 1,841 | 2,632 | 2,749 | 5,031 | 1,031 | 169 | 13,654 |
| **Forecast** | | | | | | | |
| 2001/02 | 1,860 | 2,861 | 2,764 | 5,044 | 1,015 | 180 | 13,723 |
| 2002/03 | 1,877 | 2,892 | 2,794 | 5,139 | 1,027 | 185 | 13,913 |
| 2003/04 | 1,904 | 2,935 | 2,844 | 5,244 | 1,059 | 188 | 14,173 |
| 2004/05 | 1,942 | 2,986 | 2,898 | 5,382 | 1,091 | 194 | 14,493 |
| 2005/06 | 1,963 | 3,053 | 2,967 | 5,495 | 1,126 | 197 | 14,800 |
| 2006/07 | 2,002 | 3,121 | 3,044 | 5,641 | 1,158 | 203 | 15,169 |
| 2007/08 | 2,031 | 3,198 | 3,129 | 5,787 | 1,193 | 207 | 15,544 |
| 2008/09 | 2,073 | 3,276 | 3,217 | 5,932 | 1,229 | 214 | 15,941 |
| 2009/10 | 2,104 | 3,359 | 3,311 | 6,083 | 1,269 | 220 | 16,345 |
| 2010/11 | 2,131 | 3,446 | 3,410 | 6,246 | 1,310 | 228 | 16,770 |
| 2011/12 | 2,161 | 3,527 | 3,506 | 6,394 | 1,351 | 233 | 17,173 |
| Annual Growth Rate % from 2000/01 | | | | | | | |
| 5 years: | 1.3% | 1.5% | 1.5% | 1.8% | 1.8% | 3.1% | 1.6% |
| 11 years: | 1.5% | 2.0% | 2.2% | 2.2% | 2.5% | 3.0% | 2.1% |

**Notes:**

TCU – Transportation, Communication and Utilities
Trade – Wholesale and Retail Trade
FIRE – Finance, Insurance and Real Estate
Services – Community, Business and Personal Services
Gov't – Public Administration and Defense.

# SECTION 6 – INDUSTRIAL SALES

***General***

Total sales to industrial sector increased by 3.8% GW.h compared to fiscal 1999/00, from 17,890 GW.h in 1999/00 to 18,579 GW.h in 2000/01. The increase in fiscal 2000/01 was mainly due to two factors: lower than expected hydroelectric generation and significant increases in prices of natural gas. Precipitation in the Pacific Northwest was below normal in recent years. As a result, customers in BC that depend on hydro generation to meet their power needs were required to increase their purchase of electricity from BC Hydro. To some extent customers that rely on natural gas to supplement power generation have also switched to purchase more electricity from BC Hydro to avoid high gas costs. These increases were offset by reduced sales because of lower industrial production.

Because of dropping interest rates since the beginning of 2001, lumber prices rose due to demand for lumber for residential construction in the U.S. The rise in lumber prices was cut short by mid-year due to factors such as the fear of a deepening recession, the expiration of the Softwood Countervail Agreement, and the subsequent addition of a 19.3% countervail duty in August and an average of 12.5% anti-dumping duty in October. Lumber prices dropped to about US$200 in October due to economic uncertainty after the September 11 terrorist attack. A weakening global economy also reduced the demand for pulp and paper. Pulp prices dropped from over US$520 per tonne in the second quarter of 2001 to around US$450 per tonne in the third quarter of 2001. Much downtime by producers was required to reduce inventory in the second half of 2001 when it was clear that more production curtailments would be needed. Newsprint prices were hit hard in 2001 by a 10% drop in consumption by U.S. daily papers, tumbling prices to below US$500 a tonne from a high of US$600 a tonne in March. Reduction in sales to the forest product sector were offset somewhat by higher sales to the mining sector. Sales to BC's coal mines were kept stable because of renewed interest in coal-fired power generation. The impact from the closure of a coal mine in northeast BC was compensated by higher shipments from mines in southeast BC. Sales to BC's metal mines were also higher than expected. Copper shipments from operating mines were steady due to shutdowns of production capacity around the world over the last few years.

***Short Term***

There is a direct and tangible link between the global economy and BC's resource-based exports. Six resource-based industries still account for over three-quarters of the value of BC's total international exports: wood, pulp and paper, agriculture, fishing, mining and energy. The assumption is that economic activity and industrial production in the U.S. will increase compared to 2001. Therefore, the expectation is that prices for resource-based products will improve and a gradual recovery in the BC resource-based industry will occur through the course of 2002. Low interest rates are expected to translate into low mortgage rates, providing the push for higher housing demand. More residential construction should lead to improvement in lumber prices and added lumber exports. Market conditions will remain the single biggest factor as far as lumber production in 2002 is concerned because higher export prices will be allowed to flow-through to end consumers if market conditions are good.

Demand for pulp and newsprint remains weak worldwide due to low shipments. The global pulp and paper market will remain soft until there is an increase in demand. With more production curtailment and a strengthening economy, the expectation is that there will be some improvement in pulp and newsprint prices towards the second half of 2002.

Over the last few years, much base metal production capacity has been removed around the world because of weak prices. Demand for base metals is expected to grow faster than supply when industrial production resumes. As a result, base metal prices can be expected to improve quickly as soon as an economic recovery begins to emerge. Coal prices have remained relatively stable through 2001 due to renewed interest in using coal as a fuel for power generation. BC's coal mines produce mainly metallurgical coal, which is used for the production of steel. Over the last year, some lower quality metallurgical coal was drawn into the power market because of high electricity prices. Coal shipments are expected to remain steady because economic growth will lead to increase in electricity demand and therefore the need for more coal for power generation.

***Long Term***

Projected increases in industrial electricity use are the result of a number of factors: changing product mixes, the addition of more value-added production, and more automation. Increasing demands to preserve the natural environment and growing pressures from global competition will require BC's resource-based industries to shift to a greater degree of value-added manufacturing, as well as to utilize new technologies and previously untapped resources. By definition, value-added products would require the substitution and enrichment of valuable raw materials by other inputs including energy, resulting in end products with a higher energy content.

Productivity gains from computerization were credited with being a major factor enabling the high economic growth, low inflation economic environment to flourish in the 1990s. There is a lack of hard information on the amount of electricity actually being consumed by millions of computers and computer-based devices in industries. As increasingly more production is being computerized, the distinction between various automated and computerized controls and processes is becoming less clear. However, automation and computerization would imply the enhancement of labor-intensive input by machinery and computer-based devices, resulting in an increase in energy requirements.

While BC's non-resource based economy is becoming increasingly more important, the extraction and processing of primary resources is expected to remain a significant business activity in BC. Moderate growth in BC's industrial sector is expected to occur with changes at the policy level and more investment in capital projects.

Industrial sales are projected to increase from 18,579 GW.h in 2000/01 to 18,855 GW.h by 2005/06 and to 20,682 GW.h by 2011/12.These increases represent average annual growth rates of 0.3% and 1.0%.

In 2000/01, BC Hydro sold 14,952 GW.h of electricity to its large industrial (transmission) customers, an increase of 6.3% over the 14,062 GW.h sold in 1999/00. Sales to industrial transmission voltage customers are forecast to decrease to 14,833 GW.h by 2005/06 and increase to 16,180 GW.h by 2011/12. These changes represent average annual growth rates of 0.2% and 0.7% respectively. The remainder of industrial sector sales are to

the numerous, smaller industrial customers on distribution voltage service.

The five major industrial subsectors are:

- Metal mining
- Coal mining
- Paper and allied products
- Wood manufacturing
- Chemicals and chemical manufacturing

Sales to remaining industrial transmission rate customers are combined under "Remaining Transmission Rates". Sales to other miscellaneous industrial customers are combined under "Industrial Distribution Sales". In 2000/01, sales to the transmission rate customers in the five major subsectors comprised 90% of all transmission rate sales, and 76% of total industrial sales.

Figure 6-1 shows the 2000/01 the sales share to each industrial sub sector and Figure 6-2 and Table 6-1 summarizes the industrial sales forecast by major sector.

**Figure 6-1**
**2000/01 Sales Share to BC Hydro Industrial Customers**

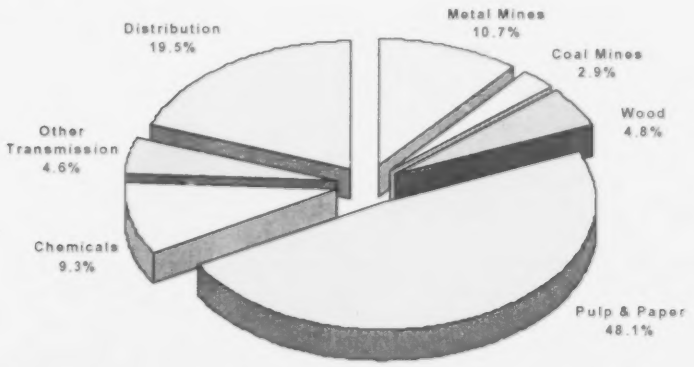



**Figure 6-2**
**Industrial Sales Forecast by Major Sector**

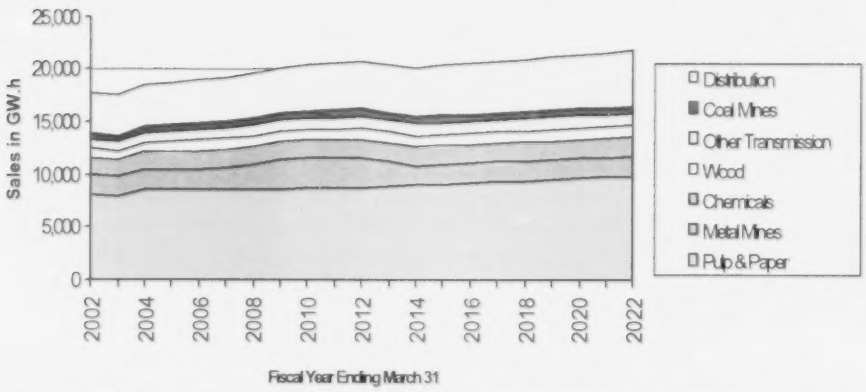


TABLE 6-1

INDUSTRIAL ELECTRIC SALES FORECAST
By Major Sector and Rate

| Fiscal Year | Transmission Rate Customers | | | | | | Distri-bution Rate (GW.h) | Total Sales (GW.h) |
|---|---|---|---|---|---|---|---|---|
| | Metal Mines (GW.h) | Coal Mines (GW.h) | Wood Mftg (GW.h) | Paper and Allied (GW.h) | Chemical & Chem Products (GW.h) | Remaining Transmission Rate (GW.h) | | |
| **Actual** | | | | | | | | |
| 1996/97 | 1,647 | 658 | 707 | 8,365 | 1,578 | 758 | 3,736 | 17,447 |
| 1997/98 | 1,602 | 662 | 769 | 7,076 | 1,694 | 750 | 3,786 | 16,339 |
| 1998/99 | 2,006 | 574 | 765 | 8,501 | 1,685 | 727 | 3,820 | 18,077 |
| 1999/00 | 1,620 | 558 | 826 | 8,685 | 1,710 | 663 | 3,828 | 17,890 |
| 2000/01 | 1,996 | 547 | 892 | 8,937 | 1,724 | 856 | 3,627 | 18,579 |
| **Forecast** | | | | | | | | |
| 2001/02 | 1,907 | 542 | 864 | 8,076 | 1,546 | 915 | 3,807 | 17,656 |
| 2002/03 | 1,758 | 546 | 822 | 7,949 | 1,640 | 900 | 3,847 | 17,462 |
| 2003/04 | 1,848 | 569 | 896 | 8,558 | 1,706 | 943 | 3,891 | 18,410 |
| 2004/05 | 1,848 | 586 | 990 | 8,494 | 1,744 | 983 | 3,952 | 18,596 |
| 2005/06 | 1,905 | 614 | 994 | 8,584 | 1,744 | 993 | 4,022 | 18,855 |
| 2006/07 | 2,048 | 669 | 996 | 8,564 | 1,744 | 1,018 | 4,074 | 19,112 |
| 2007/08 | 2,348 | 679 | 997 | 8,499 | 1,744 | 1,118 | 4,148 | 19,532 |
| 2008/09 | 2,698 | 676 | 997 | 8,609 | 1,744 | 1,128 | 4,231 | 20,083 |
| 2009/10 | 2,848 | 676 | 997 | 8,619 | 1,744 | 1,128 | 4,320 | 20,332 |
| 2010/11 | 2,848 | 676 | 1,047 | 8,619 | 1,744 | 1,128 | 4,412 | 20,473 |
| 2011/12 | 2,848 | 674 | 1,049 | 8,722 | 1,752 | 1,135 | 4,502 | 20,682 |
| Annual Growth Rate % 11 years: | | | | | | | | |
| 00/01-11/12 | 3.3% | 1.9% | 1.5% | -0.2% | 0.1% | 2.6% | 2.0% | 1.0% |

# SECTION 7 - REGIONAL PEAK FORECAST

Regional peak forecasts are an outlook of the peak demand for electricity for each of the four BC Hydro planning regions (i.e. Lower Mainland, Vancouver Island, South Interior, and Northern Region). These forecasts are typically generated for a 20-year period and are used to support transmission and distribution planning requirements. Aggregating the regional peak forecasts produces the total integrated system peak forecast, used for generation planning purposes.

This section describes the process of generating regional peak forecasts and their aggregation to form an integrated system peak. It includes an explanation of the methodology used to generate the forecast, a discussion of the regional economic outlook and trends in electric space heating.

***Regional Peak Forecast***

**Methodology**

Within each region the peak is composed of the demand for electricity at the distribution level (i.e. residential and commercial/light industrial loads), transmission customer loads (i.e. large industrial loads) and any inter-utility sales plus losses.

BC Hydro prepares regional distribution peak forecasts for ten distribution areas in British Columbia: Vancouver Island North/Central, Vancouver Island South, South Interior, North Region, and six Lower Mainland areas. The forecasts are driven by three primary factors: 1) economic forecasts, 2) electric space heating forecasts, and 3) short-term forecasts of account additions. Econometric models are used to translate these driving variables into distribution peak forecasts for each region.

Transmission customer load forecasts are developed individually for BC Hydro's approximately 120 transmission voltage customers. These are based on knowledge of their markets, production plans, production scheduling, and technology.

Total peak forecasts for each region are obtained by summing the distribution and transmission peak forecasts. Coincidence factors are applied to both, prior to summation, to account for load diversity (i.e. differences in the timing of distribution substation and transmission customer peaks relative to the aggregate regional peak). These coincidence factors are based on analyses of historical data.

Inter-utility capacity sales and firm capacity exports are included in the regional peak forecasts at the point of sale.

Included in the regional peak forecast are distribution losses because the forecasts are prepared at the substation level and represent the sum of regional substation peaks. Transmission losses are included in the integrated system peak forecast only.

The BC Hydro integrated system peak forecast is the coincident sum of the four regional peak forecasts, plus a forecast of the total transmission losses at the time of the system peak. The assumed inter-regional coincidence factors and transmission loss factors are based on historical data.

***Regional Economic Forecast***

At the distribution level, electricity demand is closely linked to the forecast of the local economy. As such, regional economic outlooks are one of the primary inputs into regional peak demand forecasts.

BC Hydro obtains economic forecasts from BC Stats, external consultants, and the Greater Vancouver Regional District.

The BC economy is dependent on several factors. In recent years, the economic conditions in Asia have had an impact in all regions in BC through declined international immigration and diminished demand for many of the commodities of the BC resource economy. Further demand fluctuations are anticipated in the short-term as a result of the global slowdown and the expected gradual recovery in the U.S. economy. In addition, supply constraints in many sectors (i.e. declining annual allowable cut, salmon conservation, and reduced investment in mining exploration) have exacerbated some of these economic problems.

The current economic outlook for BC assumes a continued gradual improvement over the next few years. This improvement will be supported by some upturn in commodity markets; renewed growth in Asia and the U.S., and a modest upswing in population growth as BC is expected to attract more retirees and international migrants. Regional and sector swings in the economy, consistent with commodity cycles, will however continue.

Figure 7-1 outlines the differences in population growth in different areas of the province. Population is expected to grow fastest in the suburban areas of the Lower Mainland particularly the Fraser Valley and Coastal areas. Differences in regional economic growth rates reflect demographic characteristics, migration and retirement settlement preferences, land availability, relative housing costs, and industry outlooks. Several regions will be affected by reductions in resource supply and international demand, which will be partially offset by growth in the service, tourism and technology sectors.

The following sections outline the economic trends and issues affecting the regional peak forecast in each of the four planning regions.

**Lower Mainland**

The Lower Mainland region encompasses the Greater Vancouver and Fraser Valley areas. It is divided into six planning areas to account for differences in growth.

Interprovincial and international migration has a significant impact on the Lower Mainland region, particularly in Greater Vancouver. In the early 90's, the Region benefited from extremely high levels of net migration from Asia and from other provinces in Canada. In 1999 and 2000 however, population growth has slowed to less than one percent. A downturn in the financial climate of Pacific Rim countries and a decline in the BC economy relative to other provinces in Canada have resulted in less people coming to the Lower Mainland. Despite the reversed population trend, Greater Vancouver's share of the total international migration has continued to increase. This reflects the area's attractiveness for those migrating from abroad.

The forecast for the Lower Mainland reflects the continued adoption of the Growth Management Strategy from the Greater Vancouver Regional District's (GVRD's) Livable Region Strategic Plan. The plan is used as a guideline for the pattern of growth in the region and is aimed at containing "urban sprawl" by planning development at a regional level. The plan also reinforces an existing trend toward denser housing, with multiple housing units (apartments and townhouses) outpacing single detached housing over the forecast period (Figure 7-2).

Aside from the importance of population growth as an economic driver, the region's economic diversity is a key factor in the forecast. The Lower Mainland's economic diversity in knowledge based, high technology and tourism sectors has sheltered it from much of the down turn experienced in the resource dependent regions of the Province.

## Vancouver Island

The Vancouver Island region is comprised of two planning areas, Vancouver Island South and Vancouver Island North/Central. These are forecast separately due to the differences in each area's characteristics and economic drivers.

## Vancouver Island South

Vancouver Island South has a varied economic base that includes inputs from public administration, tourism and resource sectors while supporting a large retirement community.

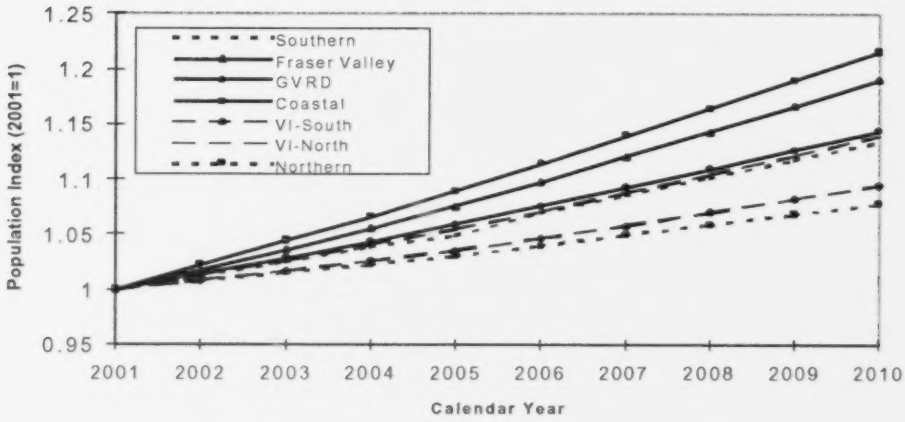
The public sector is a major component of the area's economy due to the presence of the Provincial Legislature and a large contingent of Federal employees. It is anticipated that fiscal restraint resulting from efforts to reduce the Provincial debt and deficit will limit growth in the sector.

Tourism is also a large contributor to the economy. The growth in this sector has declined in recent years and it is expected that the sector will continue to experience some difficulty throughout the short-term due to the impacts of the terrorist attacks in the U.S. this past fall.

Although the forest sector plays a relatively small role in South Vancouver Island as a whole, it is a maior contributor to the economy of the area around Duncan. After several years of declining activity, the forest sector will continue to be influenced by recovering Asian markets and pulp prices. Expansion within the sector will however, be constrained due in part to a longer recovery period in Japanese demand for BC lumber; resolution to issues on lumber exports to the U.S.; and growing international competition in pulp and paper.

## FIGURE 7-1

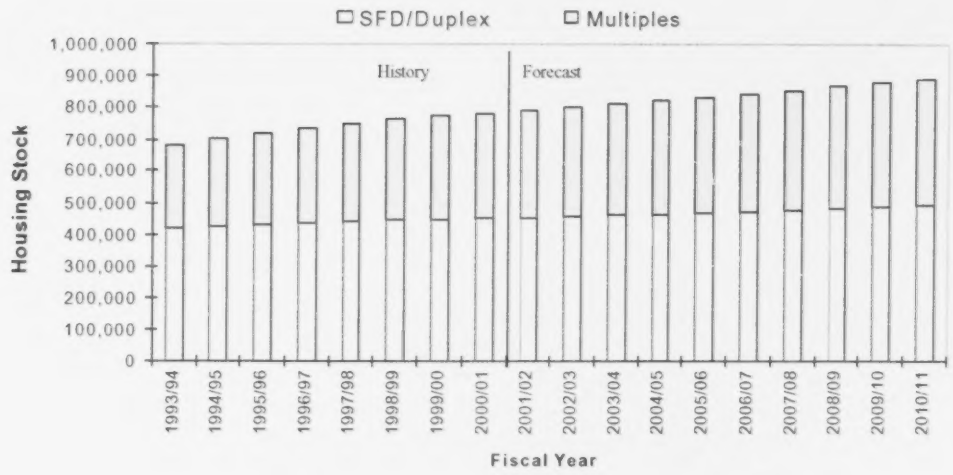
## 2001 Regional Population Growth Forecast




**Notes:**
1. Coastal includes Squamish, Whistler, Sunshine Coast and Powell River.

## FIGURE 7-2

## 2001/02 Lower Mainland Housing Stock Forecast



**Vancouver Island North/Central**

Economic growth in the Vancouver Island North/Central area depends heavily on the performance of the resource based industries. The forestry sector is the largest single contributor to the region's economy. Fishing and mining also play significant roles in many communities.

The downturn in the Asian economy continues to plague BC's coal industry and uncertainty has postponed the redevelopment of the Cumberland Coal mine at Tsable River. Since a large share of BC's coal is exported to Japan, it will take a reversal in Japan's coal market to precipitate strong growth in BC's coal industry.

Commercial fishing has been adversely impacted in recent years due to decreased stocks, a focus on conservation, and a Federal Government strategy to reduce the size of the west-coast fishing fleet. It is expected that the industry will continue to experience further rationalization over the forecast period. The outlook for the aquaculture sector is more promising. The farming of fish and shell-fish are a large and growing portion of BC's exports, which is expected to stimulate economic growth in many communities affected by the declines in the commercial salmon fishery.

Overall, the region is expected to be entering a period of slow economic growth in the short-term spurred by some strengthening in key resource markets and a gradual increase in net interprovincial migration.

**South Interior**

BC's South Interior encompasses three distinct areas, East Kootenay, Thompson Okanagan and West Kootenay. West Kootenay is not explicitly considered in this forecast because it is not serviced by BC Hydro.

While the South Interior is resource dependent, it also benefits from some economic diversity in tourism. The bulk of forestry output in the region is in lumber production destined for the U.S., rather than pulp and paper destined for other international markets. Challenges for growth in the sector exist due to outstanding trade issues related to lumber exports; strength of the housing market in the U.S.; and declines in the allowable annual forestry cuts in some areas within the region.

The region's coal, copper, lead and zinc mines continue to be affected by the economic slowdown in Asia. Despite a recovery in copper prices in 2000, recent price declines have created some uncertainty for expansion within the industry. In the short-term this may limit employment growth at both the Sullivan and Highland Valley Copper. A similar story exists for the coal mines in the eastern part of the region. However with an anticipated global economic recovery, it is expected that rising commodity prices and improving export markets will help to reduce inventories over the short-term.

Tourism continues to contribute a growing share of long-term area growth, fueled by a variety of ski developments, golf courses and other recreational facilities. This trend is expected to continue over the forecast period.

The forecast for the South Interior region reflects the combined effect of the uncertainty within the forestry and mining communities and the more positive outlook in the tourism and retirement centers.

**Northern Region**

The Northern Region is rich in mineral, agricultural and forest resources resulting in an economy based primarily on resource extraction. This makes the region susceptible to swings in population, employment and housing activity associated with the changing demand for resource products.

Forest products are a large and important sector in BC's Northern Region. Much of BC's lumber mill capacity resides in the northeast part of the region whose products are destined for the U.S.. While the northwest region's forestry products rely more upon Asian markets, slow increases in Asian demand; international competition; and recent trade disputes on softwood lumber exports to the U.S. are however, limiting factors for growth in the forestry industry in this region.

The region's mining sector has experienced a similar cycle. A variety of factors from low prices, environmental regulations, uncertainties over land claims and more favorable offshore investment opportunities may limit growth in the industry. This has resulted in a low level of exploration, significant delays in new mine development, some closures and continued uncertainty for employment growth. However, recent government proposals such as plans to streamline regulations and other tax incentives may potentially increase levels of mining investment and exploration. Price escalation of oil and gas in 2000 and early 2001 provided some stimulus in the eastern part of the region. However, natural gas and oil prices have steadily declined due to a lower industrial demand.

Coastal communities have been impacted by low salmon stocks, trends towards conservation and government restrictions on the size of the commercial fishing fleet. It is expected that the industry will see some stabilization during the short-term.

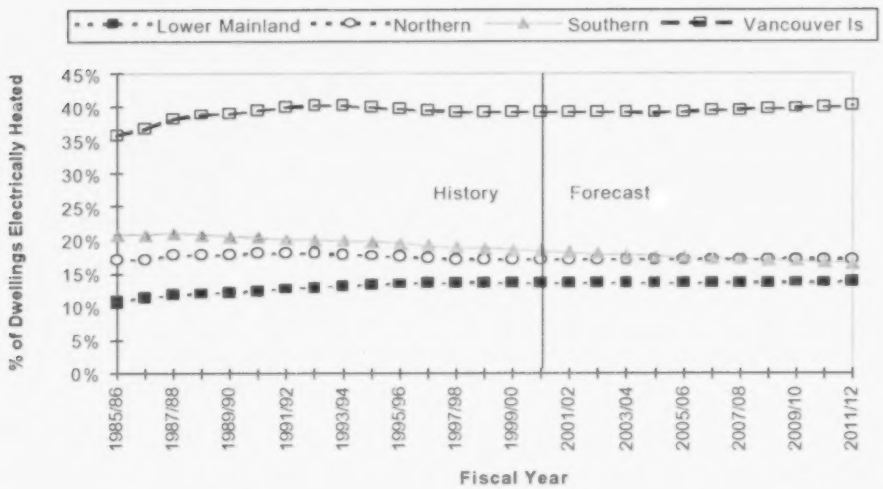
***Regional Electric Space Heating Forecast***

The penetration for residential electric space heating is another key input to the regional peak demand forecast. Figure 7-3 shows the historical and forecast share of residential accounts with electric space heating by region. The regional differences in electric space heating penetration reflect differences in the availability of natural gas and prices. Long-term increases in natural gas prices will tend to increase the penetration of electric heating in all regions of the province to some extent. These changes will occur over time because space heating is tied to the turnover of housing stock, as well as the extension of the gas distribution network.

The forecast of a gradual increase in electric space heating penetration in the Lower Mainland reflects the long-term trend toward densification of residential dwellings in the region, as shown in Figure 7-2. This is driven by apartments and row houses, which have much higher saturation rates of electric space heating than single detached homes.

The trend in electric space heating on Vancouver Island demonstrates the increased availability of natural gas following the completion of the Vancouver Island natural gas pipeline in 1991. Penetration of gas heating will be influenced by gas/electricity price differentials, market acceptance of conversions and the costs of extending the gas distribution network.

FIGURE 7-3
2001/02 Electric Space Heating Forecast by Region




***Regional Distribution and System Peak Forecast***

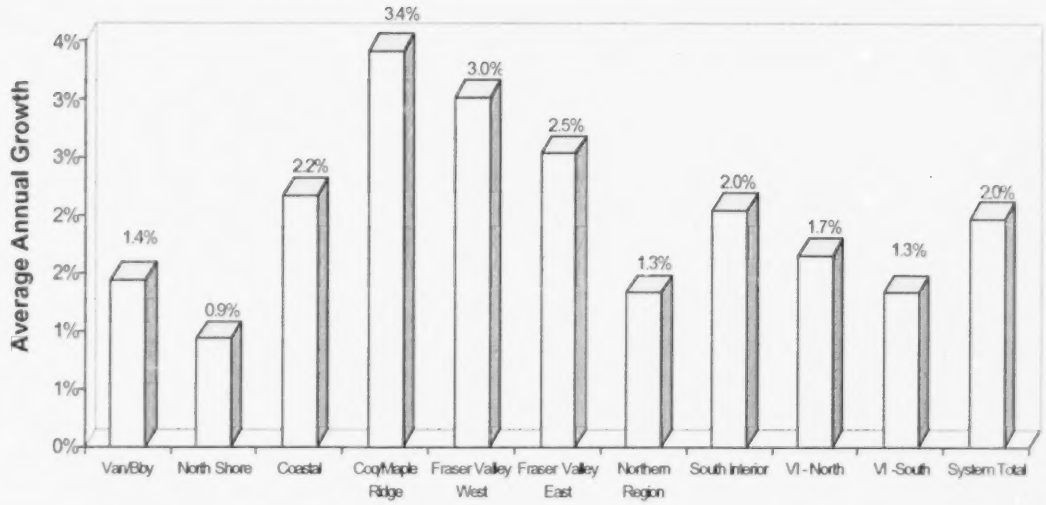
Figure 7-4 compares forecast 10-year growth rates for the ten-distribution peak forecasting areas. The highest growth areas are the suburbs of the Lower Mainland, particularly Coquitlam/Maple Ridge and Fraser Valley West.

**Regional Total Peak Forecast and Integrated System Peak Forecast**

Peak forecasts for the Lower Mainland, Vancouver Island, South Interior, and Northern Regions, and for the Integrated System are shown in Table 7-1.

## FIGURE 7- 4

### Distribution Peak Forecast
### Average Annual MVA Growth (2001/02 – 2011/12)




**Notes:**

1. Coastal includes Squamish, Whistler, Sunshine Coast and Powell River
2. Fraser Valley West includes Richmond, Delta, Surrey and Langley
3. VI South includes Greater Victoria, Duncan and the Gulf Islands

## TABLE 7-1
## Integrated System and Regional Peak Forecast
## (MW)

| | Fiscal Year | Lower Mainland | Vancouver Island | South Interior | Northern Region | Transmission Losses >60 kV | Integrated System Total |
|---|---|---|---|---|---|---|---|
| **Actual** | 1997/98 | 4,023 | 1,661 | 1,094 | 1,267 | 619 | 8,566 |
| | 1998/99 | 4,155 | 1,971 | 995 | 1,354 | 652 | 9,026 |
| | 1999/00 | 4,049 | 1,800 | 1,028 | 1,270 | 625 | 8,646 |
| | 2000/01 | 4,319 | 1,962 | 1,122 | 1,291 | 672 | 9,319 |
| **Forecast** | 2001/02 | 4,328 | 2,039 | 1,214 | 1,244 | 678 | 9,398 |
| | 2002/03 | 4,418 | 2,089 | 1,235 | 1,286 | 694 | 9,615 |
| | 2003/04 | 4,508 | 2,121 | 1,182 | 1,379 | 708 | 9,788 |
| | 2004/05 | 4,600 | 2,146 | 1,197 | 1,395 | 720 | 9,946 |
| | 2005/06 | 4,689 | 2,170 | 1,214 | 1,409 | 731 | 10,100 |
| | 2006/07 | 4,784 | 2,195 | 1,234 | 1,442 | 744 | 10,284 |
| | 2007/08 | 4,888 | 2,223 | 1,254 | 1,549 | 764 | 10,561 |
| | 2008/09 | 4,968 | 2,242 | 1,274 | 1,647 | 781 | 10,790 |
| | 2009/10 | 5,071 | 2,270 | 1,295 | 1,669 | 794 | 10,976 |
| | 2010/11 | 5,180 | 2,300 | 1,318 | 1,684 | 808 | 11,165 |
| | 2011/12 | 5292 | 2,332 | 1,339 | 1,699 | 822 | 11,357 |
| | 2012/13 | 5,388 | 2,370 | 1,348 | 1,716 | 834 | 11,528 |
| | 2013/14 | 5,486 | 2,410 | 1,357 | 1,734 | 847 | 11,703 |
| | 2014/15 | 5,590 | 2,451 | 1,366 | 1,752 | 860 | 11,888 |
| | 2015/16 | 5,690 | 2,491 | 1,376 | 1,770 | 873 | 12,065 |
| | 2016/17 | 5,796 | 2,534 | 1,385 | 1,788 | 887 | 12,255 |
| | 2017/18 | 5,898 | 2,575 | 1,394 | 1,806 | 900 | 12,436 |
| | 2018/19 | 5,998 | 2,615 | 1,404 | 1,824 | 913 | 12,614 |
| | 2019/20 | 6,103 | 2,657 | 1,414 | 1,843 | 927 | 12,803 |
| | 2020/21 | 6,207 | 2,698 | 1,423 | 1,861 | 940 | 12,987 |
| | 2021/22 | 6,309 | 2,740 | 1,433 | 1,879 | 953 | 13,170 |
| **Annual Growth Rates:** | | | | | | | |
| 5 yrs | /01-/06 | 1.7% | 2.0% | 1.6% | 1.8% | 1.7% | 1.6% |
| 11 yrs | /01-/12 | 1.9% | 1.6% | 1.6% | 2.5% | 1.8% | 1.8% |
| 21 yrs | /01-/22 | 1.8% | 1.6% | 1.2% | 1.8% | 1.7% | 1.7% |

**Notes:**

1. Regional peaks include distribution losses but not transmission losses.
2. The integrated system peak is less than the sum of the regional peaks plus transmission losses because regional peaks occur at different times.
3. Lower Mainland peak includes sales to the City of New Westminster and firm exports to Seattle City Light.
4. South Interior peak includes sales to Utilicorp Networks Canada.
5. Northern peak includes integrated system only.
6. Actual peak values are not weather normalized and peak forecast values are weather normalized.

# SECTION 8 - FORECAST PROCESS AND METHODOLOGY

***Load Forecast Process***

The load forecast process consists of four majorsteps:

- the initialization of major inputs;
- the development of a reference forecast;
- the development of a most probable forecast; and
- a management review and approval of the probable forecast.

The process generates a range of demand forecasts to reflect the outcome of different economic outlooks and uncertainties; explores implications on resources, system, and financial requirements; and selects a probable scenario for planning purposes. Fig. 8.1 summarizes this process.

(a) **Initiation of Major Inputs**

The gathering of information for updating the load forecast is an ongoing process. The following inputs form the base for preparing the 2001 long term load forecast:

(i) Information for the preparation of the population forecast is obtained mainly from the B.C. Ministry of Finance.

(ii) Input provided by outside consultants including:

- a provincial economic forecast;
- a BC Hydro Regional Economic Outlook;
- an outlook for the forest products industry (wood and pulp and paper);
- an analysis of BC's metallic minerals sector;
- a report on BC's coal mining industry;
- an analysis of world demand for copper;
- a background paper on the chemical industry;
- a study on world crude oil and North American natural gas prices.

(iii) A short term BC Economic Forecast.

(iv) A short term customer forecast prepared by each BC Hydro district office, including projections of residential and general customer additions for the next four years.

(v) Information on large industrial customers' consumption plans is obtained from BC Hydro's Key Account Managers. The latter department is in constant contact with the utility's large industrial and commercial (transmission voltage) customers. Information is obtained on an individual customer basis, and forms the basis of the industrial transmission forecast.

(b) **Development of a Reference Forecast**

The forecast is developed using a "top down/end use" approach, and is the product of two variables: stock of electricity uses, and electricity intensity per unit of stock.

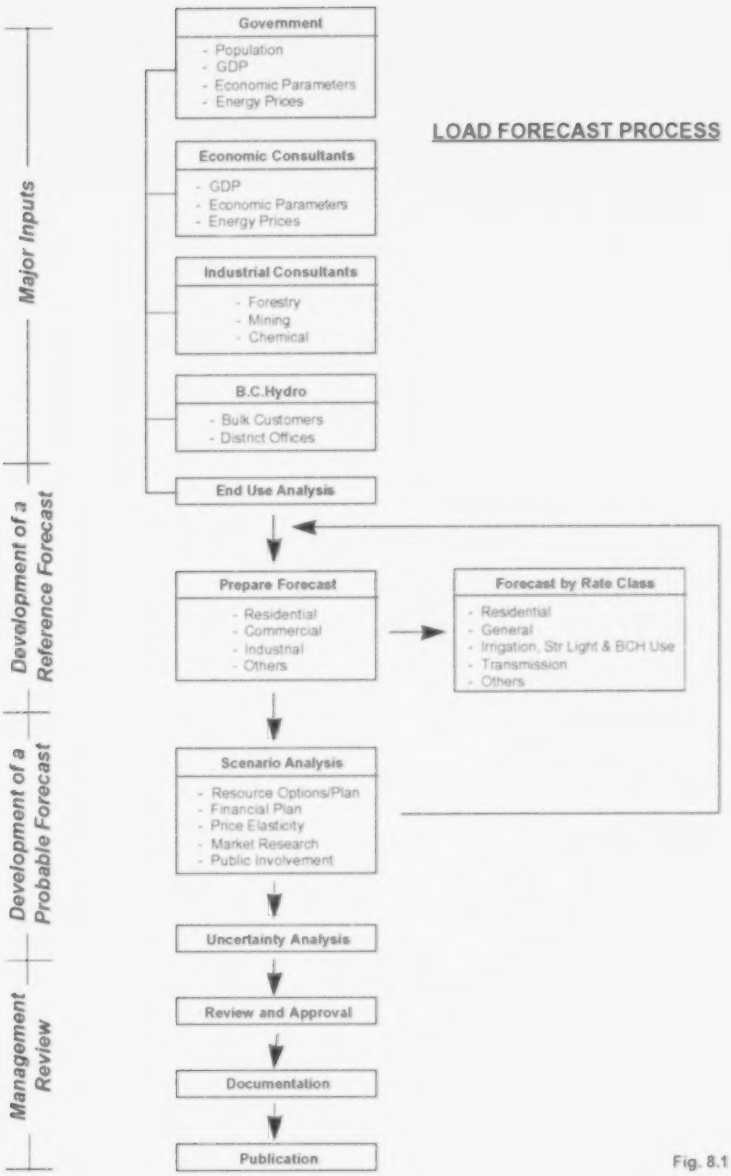

LOAD FORECAST PROCESS
Major Inputs
Development of a Reference Forecast
Development of a Probable Forecast
Management Review
Government
- Population
- GDP
- Economic Parameters
- Energy Prices
Economic Consultants
- GDP
- Economic Parameters
- Energy Prices
Industrial Consultants
- Forestry
- Mining
- Chemical
B.C.Hydro
- Bulk Customers
- District Offices
End Use Analysis
Prepare Forecast
- Residential
- Commercial
- Industrial
- Others
Forecast by Rate Class
- Residential
- General
- Irrigation, Str Light & BCH Use
- Transmission
- Others
Scenario Analysis
- Resource Options/Plan
- Financial Plan
- Price Elasticity
- Market Research
- Public Involvement
Uncertainty Analysis
Review and Approval
Documentation
Publication

Fig. 8.1

The top down aspect of the approach entails the use of the population and economic forecasts and sectoral outlooks to project "stock" in the form of household formation, commercial activity, and industrial production which generate the need for electricity.

The end use focus consists of analysis of present electricity use patterns, and of potential changes in those patterns in the future to project "electricity intensity per unit of stock" in the form of electricity consumption per housing unit, electricity input per unit of commercial floor space, and per unit of industrial production.

### (c) Development of a Probable Forecast

The Probable Forecast includes the development of short and long term projections of sales, energy, and peak requirements. Regional details by rate are developed for 11 years. Also, monthly details for the next fiscal year are prepared for use in revenue forecasts.

The Probable Forecast is developed by employing an iterative process to examine the implications of the projected load growth on Hydro's supply, demand, and financial planning functions:

- A Preliminary Resource Plan is developed by the Resource Planning group to examine resource acquisition and supply and demand options required to meet the projected load.

- A Probable Electricity Rate is developed by the Financial Services group by evaluating implications of the load forecast and resource plan on revenue and financial requirements.

- The effects of energy price changes are examined by first establishing the scope customers have for changing electricity use. Short and long term electricity elasticity factors are then applied to the three customer groups (Residential, Commercial, and Industrial) to evaluate the impact of electricity price changes on the forecast.

- The Probable Demand Forecast incorporates the savings to date resulting from demand side management programs.

- The Probable Load Forecast reflects the reduction in the demand forecast expected from continuation of existing and planned demand side management programs. The Probable Load Forecast therefore represents a forecast of the electricity usage that will be measured at the customer meter.

  Projected savings from natural conservation are included in both forecasts.

### (d) Management Review and Approval of the Probable Forecast

A Sensitivity Analysis is conducted to reflect the overall uncertainties implicit in the load forecast. The Probable Forecast and results of the Sensitivity Analysis are submitted to internal and external user groups for review. Senior management's review and approval of the Probable Forecast ensures a consistent basis for the development of resource, system, and financial plans to meet the most likely range of electricity demand requirements.

***Load Forecast Methodology***

(a) **Residential Sales**

The residential forecast is developed using two models: the population model; and the residential model. Starting with demographic projections of fertility, mortality, and migration, an age specific population forecast is developed using the cohort model for each of BC Hydro's operating divisions (regions). The provincial level results are compared and made to conform with the Ministry of Finance's population projection, and with the short term customer forecast prepared by each BC Hydro regional office. The detailed results become one input to the residential model.

The residential model is an end-use stock model. Beginning with an age specific regional population projection and using projections of headship rates and dwelling preferences, the model develops a regional housing stock for each year of the forecast. Based on a base year load profile for each dwelling type in each region, and on projections of usage trends for space heating, water heating, lighting, and other appliances, the model develops energy sales forecasts. Also included in the model are considerations of space heating fuel choices based on fuel prices, furnace efficiencies, and gas availability; demolitions, conversions, and retrofitting of housing stock; and penetrations and life cycles costs of various appliances.

REEPS, the Residential End-Use Energy Planning System, a computer model from EPRI (Electric Power Research Institute), is run in parallel with the residential model to verify the residential forecast.

A procedure also exists for developing projections of short term (three year) account additions from operating personnel in the regional offices. Starting at the district level, residential heating and non-heating (plus general under 35 kW and general 35 kW and over) category customers are added to the regional level. Regional numbers are compared to the results based on the long-term methodology, and, via consultations between Load Forecast and divisional staff, to determine short term customer numbers. The customer numbers become the basis for providing regional energy projections for distribution planning purposes.

Historical energy data essential to the forecast analysis are maintained. They are used in part for the weather normalization procedure which provides adjusted use data for the base year load profile.

(b) **Commercial Sales Methodology**

The commercial forecast for the total BC Hydro system is developed using the COMMEND (Commercial end-use planning system) model. COMMEND is an end use energy forecasting model developed by EPRI. It is used to prepare the forecast of the building-related portion of the commercial sector sales. Non-building related sales, such as transportation, communication, utilities, unclassified non-residential and small residential loads (i.e. common areas in mobile home parks), were prepared outside the model using spreadsheet analyses.

The model uses an end-use framework to provide estimates of energy use by building type and end-use. The 13 building types defined in the model are large office, small office, non-food retail, food retail, restaurant, wholesale/warehouse, hotels, hospitals, nursing homes, schools, college & university, apartments (common areas) and miscellaneous. Within each building type, energy consumed for each end-use is computed. The end uses are space heating, space cooling, ventilation, domestic water heating, refrigeration, cooking, indoor lighting, outdoor lighting, office equipment and miscellaneous.

COMMEND defines energy use as the product of three factors. These are: the amount of floorspace (floorstock); the share of floorspace using electricity, gas or oil (fuel share); and the energy use of each equipment type that is used in the buildings (Energy Use Indices, EUI). Floorspace provides a fairly accurate measurement of energy using equipment and activities in the commercial sector and is a key input to the model. The forecast of floorspace by building type was developed using population and sectoral GDP forecasts as drivers to update the floorspace forecasting equations included in the model for each building type. BC Hydro customers are coded by the North American Industry Classification (NAIC), allowing load data to be analyzed and projected in a manner consistent with the categorization of the sectoral economic drivers.

The fuel share forecast for electricity reflects the tendency of decision makers to choose the cheaper fuel alternatives when real electricity prices increase. EUI is a measure of annual energy usage per square foot of floorspace in buildings that are served by an end use. It embodies both efficiency and utilization concepts and where applicable is provided for the ten end-uses in 13 building types and by three fuel types.

The commercial forecast by subsectors is prepared by mapping the forecast of energy sales by building types produced by COMMEND onto one of the following subsectors to generate a forecast for each subsector:

- Transportation, Communications and Other Utilities
- Wholesale and Retail Trade
- Finance, Insurance and Real Estate
- Community, Business and Personal Services
- Public Administration
- Unclassified

(c) **Industrial Sales**

The industrial forecast is based on detailed analysis of each major industrial subsector. For the areas of greatest significance, which are forest products, mining, and the chemical industry, world market perspectives obtained from consultants are used as the basis of the longer term forecasts. Production levels are analyzed in relation to provincial sectoral GDP forecasts where appropriate. Patterns in energy intensity are considered in relation to technological change. Specific customer information is obtained and used to ensure consistency between the short term projections and the macro industry outlook.

The forecast is prepared on a customer specific basis for the large transmission rate accounts.

(d) **Total Gross Generation Requirements**

Total gross generation requirements are obtained by adding losses to sales estimates. Losses are based on historical differences between gross generation and sales data.

Energy losses are calculated in two steps. First, distribution losses are calculated as 4.0% of distribution sales. Distribution sales include all customers not served directly at transmission voltage (60 kV or above). Second, transmission losses are calculated as 8.1% of the total of distribution sales, distribution losses, and transmission sales. The overall result is that total losses are about 11% of total sales.

### (e) Capacity Requirements

Peak demand is forecast separately from energy demand using a "bottom up" approach: distribution and transmission customer peaks are aggregated within each region, and regional peaks are aggregated to the integrated system peak.

As explained in Section 7, distribution peak forecasts are prepared for ten areas using econometric models that relate peak growth to forecasts of regional economic indicators. Transmission voltage customers' peak demands are forecast individually based on outlooks for their markets, production technologies, and scheduling. The distribution and transmission customer peak forecasts are aggregated to four regional peak forecasts, with differences in the timing of distribution and transmission customer peaks accounted for by applying coincidence factors. The regional peak forecasts also include inter-utility capacity sales (e.g. to Utilicorp Networks Canada and the City of New Westminster) and firm capacity exports (e.g. to Seattle City Light). The regional peak forecasts are adjusted for demand side management and rate impacts on peak demand.

The integrated system peak forecast is the coincident sum of the four regional peak forecasts, plus the forecast of total transmission losses at system peak time. The assumed inter-regional coincidence factors and peak loss factor are based on historical data.

## SECTION 9 - MARKETING PROGRAMS AND POWER SMART

### *INTERRUPTIBLE MARKETING PROGRAMS (E+)*

The intent of the E+ programs was to sell secondary energy at reduced rates for space and water heating purposes with the proviso that the service would be interruptible. Secondary energy is defined as the energy often available in above low water years on BC Hydro's system. Customers can be interrupted in years when adequate secondary energy is not available, or for certain peak demand critical situations.

No new E+ interruptible accounts will be opened. Sales to all existing interruptible accounts are expected to remain at their 1990/91 levels of 253 GW.h.

### *POWER SMART PROGRAMS*

To ensure a secure supply of electricity for British Columbia, it is part of the overall BC Hydro resource strategy to promote efficient usage of electricity, as well as to enable electricity purchases from customer based generation and co-generation projects.

Specifically, demand side management programs were developed under the 2001 Power Smart Plan to encourage energy savings over the next ten years. Implementation of the full 2001 Power Smart Plan is presently being carried out in three BC communities: Comox, Courtenay and Quesnel. It will be extended to include other communities over time, as well as to encompass specifically targeted market sectors.

Projected savings resulting from implementation of the Power Smart Plan have been included in the current load forecast using the methodology in place since 1989.

The Probable Load Forecast represents the projected electricity requirements should BC Hydro only continue its demand side management at their present level. As such, the Probable Load Forecast represents an estimate of electricity requirements under existing conditions. As implementation of the 2001 Power Smart Plan accelerates and broadens it will produce additional savings which will increasingly impact future load forecasts.

# SECTION 10 - FORECAST UNCERTAINTY & SENSITIVITY ANALYSIS

***Methodology Used To Produce The Uncertainty Band***

There are two major components of uncertainty in the long-term load forecast:

- uncertainty in the future levels of major causal factors and their effect on future electricity consumption levels; and
- uncertainty about how the relationships between the major causal factors and electricity consumption may change over time.

To reflect the overall uncertainties implicit in the load forecast, five major causal factors were used to analyze the sensitivity of the probable forecast: the long-term economic growth rate (reflected by GDP); the electricity rate; the effective energy reduction achieved by demand side management (DSM) programs; the response to electricity price changes (price elasticity); and, the electricity intensity.

Probability distributions were assigned to each of the causal factors. Three values (low, probable, and high) were established to reflect possible future levels of each of the five causal factors, with a probability assigned to each.

An uncertainty model employing Monte Carlo simulation methods was used to quantify and combine the probability distributions, reflecting the relationships between the five causal factors and electricity consumption. A probability distribution was thus obtained which showed the likelihood of various load levels resulting from the combined effect of the five factors.

**The low scenario:**

There is a 10% chance the outcome will be below this value.

**The probable scenario:**

It is most likely that the outcome will equal this value.

**The high scenario**:

There is a 10% chance that the outcome will exceed this value.

Table 10-1 below summarizes the results of the uncertainty analysis on the energy and peak forecast. Figure 10.1 and 10.2 outlines the trends resulting from these uncertainties.

TABLE 10-1
FORECAST SCENARIO

| Fiscal Year | LOW LOAD | | PROBABLE LOAD | | HIGH LOAD | |
|---|---|---|---|---|---|---|
| | Integrated System Gross Requirements (GW.h) | Integrated System Peak (MW) | Integrated System Gross Requirements (GW.h) | Integrated System Peak (MW) | Integrated System Gross Requirements (GW.h) | Integrated System Peak (MW) |
| 2000/01 | 53,148 | 9,319 | 53,148 | 9,319 | 53,148 | 9,319 |
| 2011/12 | 59,721 | 10,882 | 62,328 | 11,357 | 64,892 | 11,825 |
| 2021/22 | 66,269 | 12,201 | 71,534 | 13,170 | 76,766 | 14,134 |
| Growth over 21 yrs: | 13,121 | 2,882 | 18,386 | 3,851 | 23,618 | 4,815 |
| Annual Growth Rate (21 yrs): 2000/01 - 2021/22 | 1.1% | 1.3% | 1.4% | 1.7% | 1.8% | 2.0% |

FIGURE 10-1

Total Gross Requirements

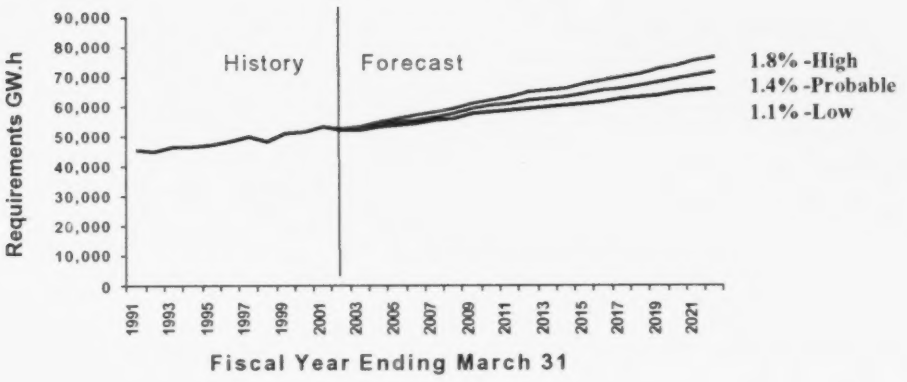
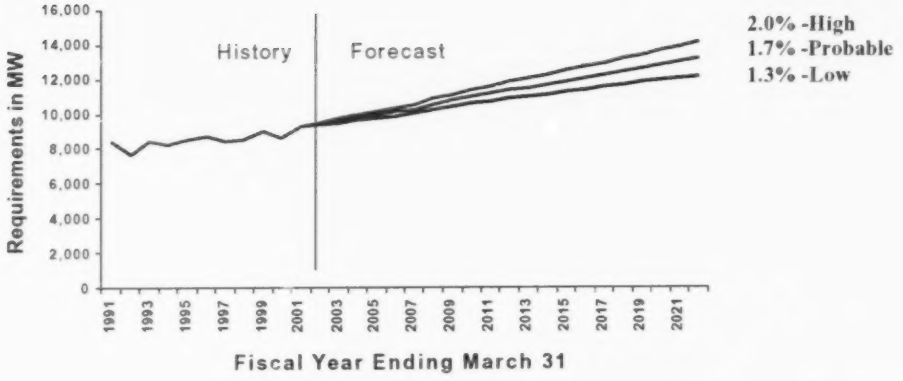



FIGURE 10-2

Peak Demand Forecast



***Uncertainty Assumptions***

For each of the five major causal factors, a probability distribution defined by low, probable, and high scenarios was assigned.

(a) **Long-Term Economic Growth (GDP)**

The long-term growth scenarios used were based on average annual GDP increases of 2.1% with a standard deviation of 0.5%.

(b) **Electricity Rates**

The probable scenario assumes that electricity prices in B.C. will decrease slightly in real terms (i.e. net of inflation) between 1999/00 and 2004/05 and then show a small increase between 2005/06 and 2009/10. The low and high scenarios assume that annual electricity rate changes will be within a 2.5% band of the probable rate changes.

(c) **Effective Energy Reduction of Demand Side Management (DSM) Programs**

The annual low, probable, and high reductions from DSM used were 50%, 100%, and 150%, respectively, of the expected reductions.

(d) **Response to Electricity Price Changes (Elasticity)**

The elasticity of electricity demand measures the change in the consumption of electricity in response to changes in variables influencing such demand. However, estimates of elasticity are subject to considerable uncertainty. The range of values of price elasticities for the various sectors is estimated to be as shown in Table 10-2. The overall price elasticity of peak demand is assumed to be 75% of the energy demand elasticity, reflecting a reduced price sensitivity of demand during very cold weather.

(e) **Electricity Intensity**

Changes in overall electricity intensity are assumed to be within a 0.2% band of the annual change in electricity intensity for that year.

**Table 10-2**
**PRICE ELASTICITIES - ENERGY DEMAND**

| | RESIDENTIAL | | COMMERCIAL | | INDUSTRIAL | |
|---|---|---|---|---|---|---|
| | Short Run | Long Run | Short Run | Long Run | Short Run | Long Run |
| Selected Range | 0.17 to 0.35 | 0.45 to 0.80 | 0.15 to 0.40 | 0.49 to 0.83 | 0.05 to 0.13 | 0.20 to 0.40 |
| Selected for Probable Forecast | 0.20 | 0.65 | 0.15 | 0.65 | 0.05 | 0.35 |

***Temperature Sensitivity Of Peak Demand***

The forecasts and uncertainty bands described in Table 10-1 assume normal weather. They do not include the effect of colder or warmer than normal (30-year average) temperatures. The temperature sensitivity of peak demand can be quantified by correlating historical peaks with temperatures, and adjusting for customer growth. The analysis indicates that for each degree that the minimum daily average temperature at Vancouver International Airport drops below normal (-6.5°C), 70 MW will be added to the 2001/02 integrated system peak. Under the most extreme cold temperature conditions (-14.5°C daily average at Vancouver, the 50-year minimum), the system peak could increase by as much as 6%. The Vancouver Island peak is more sensitive to cold temperatures than the system peak because of the high penetration rate of electric space heating on Vancouver Island. Extreme cold temperature conditions could increase the Vancouver Island peak by as much as 11%.

Analysis of the historical distribution of temperatures and the effects of customer growth indicates that there is a 90% chance that cold temperatures will add approximately less than 500 MW to the 2001/02 system peak, and approximately less than 600 MW to the 2006/07 system peak.

# GLOSSARY

| | |
|---|---|
| Consumer Price Index (CPI) | An inflation index calculated by comparing the price of a typical bundle of goods in the year in question to the price of the same goods in a set reference year. |
| Cogeneration | The sequential production of electricity and useful thermal energy or shaft power from the same fuel source. |
| Demand-Side Management | The influencing of energy demand to achieve socially economic efficiency improvements in the end use of electricity, and to shift electricity demand to reduce utility capacity costs. |
| Region | A geographical sub-division of the BC Hydro service area. Four regions exist: Lower Mainland, Vancouver Island, South Interior, and the Northern Region. |
| Distribution voltage customer | A BC Hydro customer who receives electricity via distribution lines that operate at relatively low voltage (34 kV and less). |
| Diversity | That quality or characteristic by which individual maximum demands occur at different times. Diversity may be examined on an hourly, daily, monthly, or yearly basis. |
| Econometric modelling | The use of statistical techniques, typically regression analysis of time-series and/or cross-sectional data, to detect statistically verifiable relationships, coherent with economic theory, between an explained variable (e.g. electricity consumption) and explanatory variables (e.g. industry output, prices of alternative energy inputs, and GDP). |
| Elasticity | The proportionate change in a dependent variable, (e.g. electricity consumption, divided by the proportionate change in a specified independent variable; electricity price). A dependent variable is highly elastic with respect to a given independent variable if the calculated elasticity is much greater than one. The dependent variable is inelastic if the elasticity is less than unity. |
| End-use model | A model used to analyze and forecast energy demand, which focuses on the end-uses or services provided by energy. Typical end-uses are lighting, process heat, and motor drive. For a given industry, the model estimates |

| | |
|---|---|
| | the influence of prices and technological change on the evolution of the secondary energy inputs required to satisfy the industry's end-uses over time. |
| Energy | The amount of electricity delivered or consumed over a certain time period, measured in multiples of watt hours. A 100 watt bulb consumes 200 watt hours in 2 hours. A typical BC Hydro residential account consumes about 10 000 kW.h (10 million watt hours) annually. |
| Gross Domestic Product (GDP) | A measure of the total flow of goods and services produced by the economy over a specified time period, normally a year or quarter. It is obtained by valuing outputs of goods and services at market prices (alternatively at factor cost), and then aggregating. |
| Gigawatt hour (GW.h) | A measure of electrical energy, equivalent to one million kilowatt hours. |
| Integrated system | That portion of the BC Hydro system which is connected as one whole. Non-integrated facilities refer to generating facilities which are not connected to the system, located in remote areas of the province. |
| kilowatt-hour (kW.h) | A measure of electrical energy, equivalent to the energy consumed by a 100 watt bulb in 10 hours. |
| Load | The total amount of electrical power demanded by the utility's customers at any given time, typically measured in megawatts (MW). |
| Megawatt (MW) | A unit used to measure the capacity or potential to generate or consume electricity. One MW equals one million watts. |
| Monte Carlo method | A technique for estimating probabilities involving the construction of a model and the simulation of the outcome of an activity a large number of times. Random sampling techniques are used to generate a range of outcomes. Probabilities are estimated from an analysis of this range of outcomes. |
| Natural conservation | The increase in energy efficiency that would occur in the absence of any utility-induced DSM program, all other things being equal. |
| Normalization | The correction of actual customer sales and peak demand for unusually warm or cold weather. |

| | |
|---|---|
| Price elasticity of demand | The percentage change in quantity demanded, divided by the percentage change in price which caused the change in quantity demanded. |
| Real price increases | Increases that have been adjusted for changes in prices of all goods. The nominal price of an item may rise by 10% over a year, but inflation (and assumed wages) may have risen by 7% over the same time period. Therefore the effective price increase faced by the consumer is 3%. It is necessary to deflate current prices by an appropriate inflation index (the CPI in Canada) to convert money values to constant prices or real terms. |
| System peak demand | The greatest combined demand of all BC Hydro customers faced by the generation system during a given fiscal year. |
| Transmission voltage customer | A BC Hydro customer which is supplied its electricity via high voltage transmission lines (60 kV or above). |
| Units of measure | The large amounts of electricity generated and consumed on a system wide basis are discussed in multiples of the basic units of watt and watt hours. Kilowatts and megawatts are used to measure power, and kilowatt hours, megawatt hours, and gigawatt hours are used to measure energy. The equivalences are:<br>1 kilowatt (kW) = 1000 watts<br>1 megawatt (MW) = 1000 kilowatts or 1 million watts<br>1 kilowatt hour (kW.h) = 1000 watt hours<br>1 megawatt hour (MW.h) = 1000 kilowatt hours or 1 million watt hours<br>1 gigawatt hour (GW.h) = 1000 megawatt hours or 1 billion watt hours |

## B.C. HYDRO HISTORICAL AND PROBABLE ELECTRIC SALES FORECAST BY RATE CATEGORIES
(Billed Sales, No Adjustment for Accrual)

| Fiscal Year | Residential (GW.h) | General Under 35 kW (GW.h) | General 35 kW & Over (GW.h) | Trans. Rate (GW.h) | | Irrigation (GW.h) | Street Lighting (GW.h) | BCH Own Use (GW.h) | Firm Domestic Marketing (GW.h) | | Firm Export + Inter-Utility (GW.h) (a) | Total Billed Sales (GW.h) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Actual** | | | | | | | | | | | | |
| 1989/90 | 11,002 | 2,835 | 9,950 | 13,375 | | 58 | 241 | 68 | 1,041 | | 714 | 39,284 |
| 1990/91 | 11,783 | 2,963 | 10,293 | 13,828 | | 58 | 235 | 68 | 1,105 | | 933 | 41,266 |
| 1991/92 | 11,606 | 2,906 | 10,385 | 13,506 | | 63 | 222 | 57 | 740 | | 865 | 40,350 |
| 1992/93 | 12,330 | 3,017 | 10,782 | 12,985 | (b) | 77 | 209 | 61 | 768 | | 1,301 | 41,530 |
| 1993/94 | 12,439 | 2,958 | 11,065 | 13,385 | | 53 | 196 | 55 | 823 | | 1,063 | 42,037 |
| 1994/95 | 12,916 | 3,015 | 11,501 | 13,181 | | 78 | 214 | 56 | 654 | (c) | 1,040 | 42,655 |
| 1995/96 | 13,300 | 3,060 | 11,686 | 14,474 | | 73 | 200 | 57 | | | 740 | 43,590 |
| 1996/97 | 13,983 | 3,098 | 12,009 | 14,182 | | 68 | 201 | 57 | | | 764 | 44,362 |
| 1997/98 | 13,802 | 3,313 | 12,163 | 13,004 | (b) | 58 | 208 | 58 | | | 777 | 43,383 |
| 1998/99 | 13,972 | 3,534 | 12,250 | 14,751 | | 87 | 211 | 58 | | | 942 | 45,805 |
| 1999/00 | 14,572 | 3,581 | 12,450 | 14,697 | (b) | 65 | 215 | 59 | | | 1,052 | 46,691 |
| 2000/01 | 14,573 | 3,620 | 12,651 | 15,615 | | 69 | 217 | 60 | | | 1,399 | 48,204 |
| Annual Growth Rate % incr. 11 years: | | | | | | | | | | | | |
| 89/90-00/01 | 2.6% | 2.2% | 2.2% | 1.4% | | 1.6% | -0.9% | -1.1% | | | 6.3% | 1.9% |
| **Forecast** | | | | | | | | | | | | |
| 2001/02 | 14,833 | 3,661 | 12,864 | 14,503 | | 70 | 220 | 61 | | | 1,326 | 47,539 |
| 2002/03 | 15,042 | 3,724 | 13,033 | 14,263 | | 72 | 222 | 61 | | | 1,238 | 47,656 |
| 2003/04 | 15,285 | 3,787 | 13,240 | 15,196 | | 74 | 225 | 62 | | | 1,121 | 48,989 |
| 2004/05 | 15,529 | 3,867 | 13,502 | 15,355 | | 75 | 227 | 62 | | | 1,101 | 49,718 |
| 2005/06 | 15,750 | 3,949 | 13,781 | 15,555 | | 77 | 230 | 63 | | | 1,117 | 50,522 |
| 2006/07 | 15,987 | 4,043 | 14,089 | 15,775 | | 78 | 233 | 63 | | | 1,143 | 51,412 |
| 2007/08 | 16,240 | 4,144 | 14,432 | 16,121 | | 80 | 236 | 64 | | | 1,156 | 52,472 |
| 2008/09 | 16,506 | 4,248 | 14,789 | 16,603 | | 81 | 239 | 64 | | | 1,165 | 53,695 |
| 2009/10 | 16,782 | 4,359 | 15,166 | 16,763 | | 82 | 242 | 65 | | | 1,176 | 54,635 |
| 2010/11 | 17,058 | 4,475 | 15,562 | 16,813 | | 83 | 246 | 65 | | | 1,187 | 55,490 |
| 2011/12 | 17,342 | 4,583 | 15,936 | 16,937 | | 85 | 249 | 66 | | | 1,204 | 56,401 |
| Annual Growth Rate % incr. 11 years: | | | | | | | | | | | | |
| 00/01-11/12 | 1.6% | 2.2% | 2.1% | 0.7% | | 1.9% | 1.2% | 0.8% | | | -1.4% | 1.4% |

**Notes:**

(a) "Firm Export & Inter-Utility" column includes: New Westminster, Point Roberts, Hyder, Out of Province (Alberta), Seattle City Light and Utilicorp Networks Canada.

(b) Labour disruptions caused reductions in Transmission Rate sales.

(c) Rate 1845 ended Dec 31/94.